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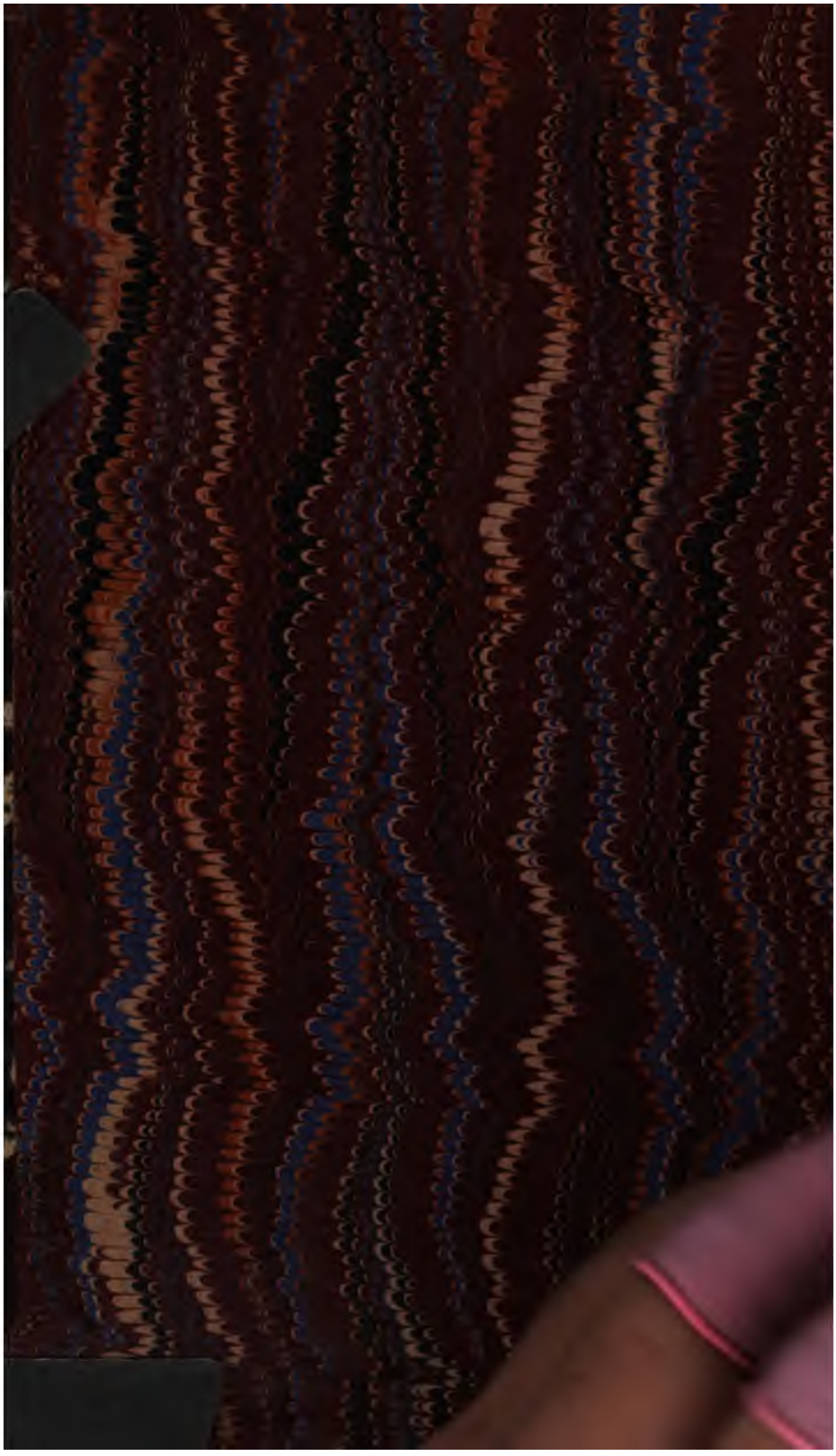

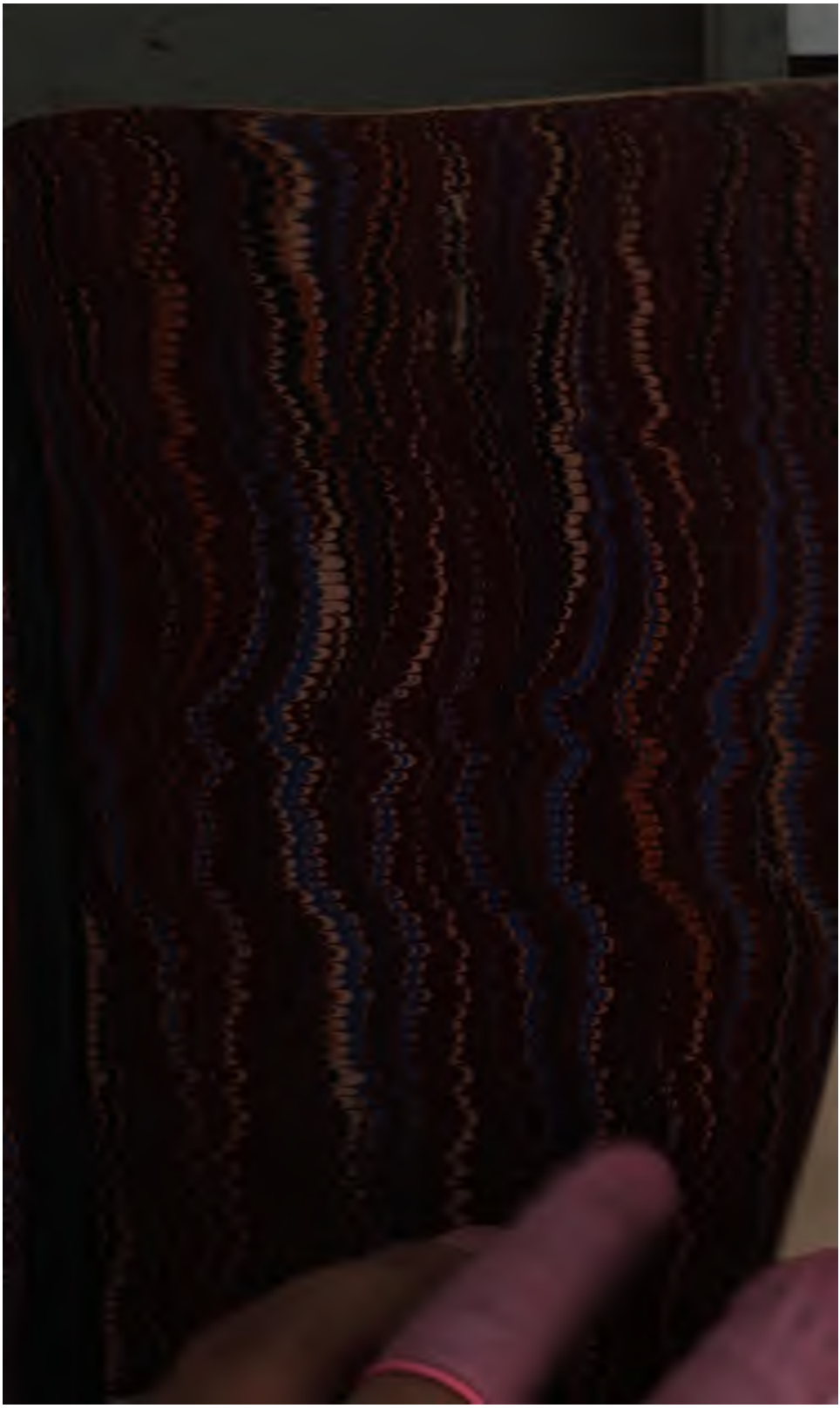

PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1876.

PUBLICATION COMMITTEE.

JOSEPH LEIDY, M.D., GEO. W. TRYON, JR.,
WM. S. VAUX, W. S. W. RUSCHENBERGER, M.D.,
GEO. H. HORN, M.D.

EDITOR: EDWARD J. NOLAN, M.D.

PHILADELPHIA:
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HALL OF THE ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, February, 1877.

I hereby certify that printed copies of the Proceedings for 1876 have been presented at the meetings of the Academy, as follows:—

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"	105 to 120	August	8, 1876.
"	121 to 152	September	5, 1876.
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"	201 to 232	January	2, 1877.
"	233 to 264	"	9, 1877.
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EDWARD J. NOLAN, M.D.,
Recording Secretary.

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With reference to the several articles contributed by each.

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PROCEEDINGS

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ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1876.

JANUARY 4, 1876.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-four members present.

On Petalodus.—Prof. LEIDY exhibited a tooth of Petalodus, which in shape and size resembles those from the carboniferous limestone of Illinois, described by Dr. Newberry under the name of *P. linguifer*. The specimen was brought to his notice only this evening by Edward Bradin, a medical student of the University, who desired to know what it was. It was stated to have been found by another student, Oakford D. Acton, in the green sand marl, about six miles from Salem, New Jersey. Remains of the genus have previously never been found in formations later than those of Carboniferous age, and it was therefore open to suspicion whether the present specimen really belonged to the green sand deposit of Cretaceous age. Some portions of ash-colored matter adherent to the tooth consist of carbonate of lime, and this would indicate that the specimen had been derived from limestone.

JANUARY 11.[1]

The President, Dr. RUSCHENBERGER, in the chair.

Sixty-one members present.

[1] NOTE.—This day the Society met in its new building, S. W. corner of Race and Nineteenth Streets, for the first time.

JANUARY 18.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-three members present.

JANUARY 25.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-five members present.

The following were elected members: Chas. L. Sharpless, Dr. Alfred Whelen, Rev. W. Q. Scott, Dr. Henry M. Fisher, Edwin H. Fitler, Dr. Wm. R. Cruice, Chas. H. Rogers, and Dr. W. F. Waugh.

FEBRUARY 1.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-six members present.

A paper entitled "Description of a New Generic Type, Bassaricyon Gabbii, of Procyonidæ from Costa Rica," by J. A. Allen was presented for publication.

On a Gigantic Bird from the Eocene of New Mexico.—Prof. COPE exhibited a tarsometatarsus of a bird, discovered by himself during the explorations in New Mexico, conducted by Lieut. G. M. Wheeler, U. S. A. The characters of its proximal extremity resemble in many points those of the order *Cursores* (represented by the *Struthionidæ* and *Dinornis*), while those of the distal end are, in the middle and inner trochleæ, like those of the *Gastornis* of the Paris Basin. Its size indicates a species with feet twice the bulk of those of the ostrich. The discovery introduces this group of birds to the known faunæ of North America recent and extinct, and demonstrates that this continent has not been destitute of the gigantic forms of birds, heretofore chiefly found in the Southern Hemisphere faunæ. The description is as follows:—

The hypotarsus is moderately prominent, with broad truncate face, and does not inclose the ligamentous groove of its inner side. Its superior angle is broken away in the specimen. The two foramina which pierce the shaft just below the head, are well separated from each other both on the posterior and anterior faces, marking nearly equal thirds of the transverse diameter of the bone. The

cotyloid cavities for the tibio-tarsus are bounded by an elevated margin, and are separated medially by a single low oblique ridge. The groove of the posterior face is particularly wide, and the inner part of the shaft is thinned, while the outer border is broadly convex. The proximal part of the inner border (as far as it is preserved) is marked with a flat surface which is roughened with ridges, which is perhaps the sutural articulation of the proximal end of the metatarsus of the hallux. No such surface exists on the corresponding bone of the ostrich or emeu. Only two of the free distal phalangeal extremities are preserved. The shaft is broken, showing that its interior is filled with cancellous tissue. The free extremities are remarkable for the great inferior extent of the articular trochlear face. The median is strongly grooved with an obtuse excavation, and the lateral or bordering ridges are equal and rounded. The groove is continuous with the superior surface, but not with the inferior. There the convergent lateral ridges inlosing the open groove, terminate in an abrupt elevation above the adjacent surface of the shaft. The sides at this point are concave. The inner free condyle has an oblique articular face, the external ridge dropping away internally as in many birds, and produced beyond the inner ridge, distally. The articular face becomes then a part of a spiral, and is little grooved above, but strongly grooved medially. The vertical diameters of the sides differ, the inner being much greater, and both are concave. A strong foramen pierces the shaft just within the point of junction of the inner and medial free extremities.

Measurements.		M.
Transverse diameter of proximal end of tarsometatarsus		.100
Antero-posterior do. (partly inferential)		.070
Interval between penetrating foramina on anterior face shaft		.017
Median distal condyle	Long diameter	.050
	Vertical diameter	.048
	Transverse diameter	.040
Internal distal condyle	Long diameter	.037
	Vertical diameter	.040
	Transverse diameter	.031

The large size and wide separation of the penetrating foramina, and the thin internal edge with sutural articular facet, distinguish this form as distinct from any of the genera of Struthionidæ and Dinornithidæ. It is therefore named *Diatryma gigantea.*

On Strontianite and Associated Minerals in Mifflin Co.—Mr. HENRY CARVILL LEWIS remarked that it might be of interest to mention the occurrence of Strontianite in Pennsylvania—a mineral which he believed had not been heretofore recorded as occurring in our State.

He had found it quite abundantly in Mifflin County on the Juniata opposite Mount Union. It exists as tufts of white acicular

crystals, lining pockets in limestone, or when in shale, disseminated throughout the rock-mass. The specimen presented to the Academy is of the latter kind. Its geological position is in hydraulic limestone near the lower horizon of the Water Lime Group. (No. VI. of Penna. Survey.)

Several other minerals have been found associated with the strontianite; among them a strontianitic aragonite, found in fibrous crystalline crusts, generally about half an inch thick. When heated before the blowpipe it gives a red flame, and sometimes slightly exfoliates. A specimen was examined by Dr. Genth, who finds the amount of strontia present to be about one-half of one per cent.

Calcite, ferrocalcite, common aragonite, and fluorite occur at the same locality.

A statement in Prof. Rogers' "Geology of Pennsylvania" (Vol. I. p. 215), referring to the occurrence of strontianite at Marble Hall, Montgomery County, is probably incorrect; barites, which is there plentiful, being mistaken for it.

FEBRUARY 8.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

Mr. THOMAS MEEHAN remarked that the American correspondent of "Nature" had characterized some recent remarks of his on fertilization by insect agency, as an attack on Mr. Darwin. He thought the members of the Academy would bear him out in the statement that the facts and observations he had from time to time offered were submitted in no spirit of antagonism to Mr. Darwin, but often favored as much as they opposed views held by that distinguished gentleman. Even those who were avowed partisans of Mr. Darwin felt it necessary to strengthen their positions by searching for new facts; surely the mere student who was willing to wait till the evidence was all in, might offer the facts as he found them, without being liable to the charge of direct antagonism. However, he felt fortunate to-night in having two new facts to offer, one of which might favor, and the other oppose some generally accepted views.

Variation in Quercus macrocarpa.—Mr. M. remarked that among many other characters distinguishing oaks, the color of the one-year-old twigs was marked. Some species had purplish-red twigs, as, for instance, the white oak; others, as the burr oak, had gray twigs. This character was remarkably constant through all the species. He exhibited some branches of the burr oak (*Quercus macrocarpa*) in which was a tendency to develop the character of the white oak. From the articulus of the fallen leaf downwards, in some cases extending several inches, was a purple

line similar to the color of the white oak, giving the twig a striped appearance. There was no reason why the whole twig might not lose its gray color and become purple or brown, instead of partially so as now, and no reason why it might not become a permanent and enduring character. It was undoubtedly a fact favoring evolutionary views.

Self-Fertilization in Browallia elata.—Mr. MEEHAN exhibited specimens of this common green-house annual in flower and with an abundance of perfect seed, and said it had been produced from plants which had no aid whatever from insects in fertilization. The tendency of thought at the present time was to present the generalization that plants were benefited by cross fertilization; that they had come to abhor, so to say, in-and-in breeding, and that color, fragrance, and honeyed secretion in flowers had been developed in these later ages solely as inducements to insects to visit them, and thereby secure this cross fertilization. He did not regard this necessity for cross fertilization—this supposed injury to plants, from in-and-in breeding—to be proved by any means, as there are abundant evidences to the contrary. But undoubted self-fertilizers have existed as long and are every way as healthy as those that cannot now fertilize themselves. It was essential, he thought, that this point should be more fully proved before we could say much about special contrivances for insuring insect fertilization.

That there was a considerable number of plants that could only be fertilized by insect agency, was certainly true, and as remarkable as it was true, and whatever the purport of this arrangement might ultimately be proved to be, they who were working up this field and increasing the number of instances were doing inestimable service to science. But while there were instances of structure which *seem to be* specialized particularly with the object of insect fertilization, it was but right that we should not close our eyes to other structures which just as strongly *seemed* specialized to prevent it. That was the case with the Browallia now exhibited. Not only was it a fact that this plant with such an attractive blue color perfected every seed vessel without insect aid, but the structure of the flower was such that should an insect endeavor to collect the pollen it would only aid, if that were necessary, in self-fertilization. The stigma was nearly the length of the corolla tube; and the anthers, a trifle longer, were arranged closely around it. Two of these were inverted just over the stigma, their backs being densely bearded, and appearing to the naked eye like petaloid processes effectually closing the mouth of the throat. No insect could thrust its proboscis into the tube, except through this dense bearded mass, and if it had foreign pollen, would be thoroughly cleaned by the beard; but the very act of penetration would thrust these anthers forward on to the pistil, and thus aid in rupturing the pollen sacs, and of course the self-fertilization of

the flower. If we are to be told that "all flowers with brilliant colors" have been so developed by the "unconscious agency of insects," as Sir John Lubbock tells us; and if we are to regard peculiarities of structures which prevent self-fertilization, as having been arranged especially with that view and to that end, what are we to say of cases like this of Browallia, with brilliant color, and special structure favoring self-fertilization?

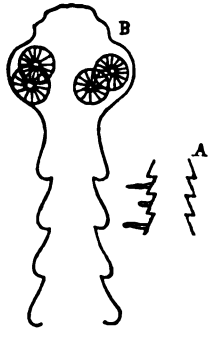
FFBRUARY 15.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty members present.

A paper entitled "Description of a Monstrosity," by H. C. Chapman, M.D., was presented for publication.

Description of a new Tænia from Rhea Americana.—Dr. CHAPMAN called the attention of the members to a new species of Tænia which he had found in the alimentary canal of the Rhea Americana. According to Diesing there exists in the Struthio a tænia, but as no description is given he could not say whether the species are the same. It is very probable, however, that they are so. If future investigation should show this to be correct, it will offer another illustration of closely related forms having the same entozoa. The tænia from the Rhea varies from 9 to 10 inches in length. Its head measures $\frac{1}{33}$ of an inch in breadth and $\frac{1}{25}$ of an inch in length (to beginning of 1st segment). The head is provided with four suckers. The cervical segments are rounded off at the articulations, but the mature ones are serrated. The genital aperture is lateral and alternates from side to side. Sometimes there will be as many as five successive segments on one side exhibiting these apertures, and then five will be seen on the opposite side of the next five successive segments. The penis could be protruded by compression and the vagina readily seen.



From the fact of the head being rather thickly set upon this species, the name *Tænia tauricollis* was proposed for it.

FEBRUARY 22.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "Descriptions of New Species of Fossils from Paleozoic Rocks of Iowa," by Chas. A. White, M.D., was presented for publication.

On the Theory of Evolution.—Prof. COPE gave a history of the progress of the doctrine of evolution of animal and vegetable types. While Darwin has been its prominent advocate within the last few years, it was first presented to the scientific world, in a rational form, by Lamarck of Paris, at the commencement of the present century. Owing to the adverse influence of Cuvier, the doctrine remained dormant for half a century, and Darwin resuscitated it, making important additions at the same time. Thus Lamarck found the variations of species to be the primary evidence of evolution by descent. Darwin enunciated the law of "natural selection" as a result of the struggle for existence, in accordance with which "the fittest" only survive. This law, now generally accepted, is Darwin's principal contribution to the doctrine. It, however, has a secondary position in relation to the *origin* of variation, which Lamarck saw, but did not account for, and which Darwin has to assume in order to have materials from which a "natural selection" can be made.

The relations exhibited by fully grown animals and plants with transitional or embryonic stages of other animals and plants, had attracted the attention of anatomists at the time of Lamarck. Some naturalists deduced from this now universally observed phenomenon, that the lower types of animals were merely repressed conditions of the higher, or in other words, were embryonic stages become permanent. But the resemblances do not usually extend to the entire organism, and the parallels are so incomplete, that this view of the matter was clearly defective, and did not constitute an explanation. Some embryologists, as Lereboullet and Agassiz, asserted that no argument for a doctrine of descent could be drawn from such facts.

The speaker, not adopting either view, made a full investigation into the later embryonic stages, chiefly of the skeleton of the Batrachia, in 1865, and Prof. Hyatt, of Salem, Mass., at the same time made similar studies in the development of the Ammonites and Nautili. The results as bearing on the doctrine of evolution were published in 1869 (in "The Origin of Genera"). It was there pointed out, that the most nearly related forms of animals do

present a relation of repression and advance, or of permanent embryonic and adult type, leaving no doubt that the one is descended from the other. This relation was termed *exact parallelism.* It was also shown, that, if the embryonic form were the parent, the advanced descendant was produced by an increased rate of growth, which phenomenon was called *acceleration;* but that if the embryonic type were the offspring, then its failure to attain to the condition of the parent is due to the supervention of a slower rate of growth; to this phenomenon the term *retardation* was applied. It was then shown that the *inexact parallelism* was the result of *unequal* acceleration or retardation; that is, acceleration affecting one organ or part more than another, thus disturbing the combination of characters, which is necessary for the state of *exact parallelism* between the perfect stage of one animal, and the transitional state of another. Moreover, acceleration implies constant addition to the parts of an animal, while retardation implies continual subtraction from its characters, or atrophy. He had also shown (Method of Creation, 1871), that the additions either appeared as *exact repetitions* of preëxistent parts, or as *modified repetitions*, the former resulting in simple, the latter in more complex organisms.

Professor Haeckel, of Jena, has added the keystone to the doctrine of evolution in his gastræa theory. Prior to this generalization, it had been impossible to determine the true relation existing between the four types of embryonic growth, or, to speak otherwise, than that they are inherently distinct from each other. But Haeckel has happily determined the existence of identical stages of growth (or segmentation) in all of the types of eggs, the last of which is the *gastrula;* and beyond which the identity ceases. Not that the four types of gastrula are without difference, but this difference may be accounted for, on plain principles. In 1874, Haeckel, in his Anthropogenie, recognizes the importance of the irregularity of time of appearance of the different characters of animals, during the period of growth, as affecting their permanent structure. While maintaining the view that the low forms represent the transitional stages of the higher, he proceeds to account for the want of exact correspondence exhibited by them at the present time, by reference to this principle. He believes that the relation of parent and descendant has been concealed and changed by subsequent modifications of the order of appearance of characters in growth. To the original, simple descent he applies the term *palingenesis;* to the modified and later growth, *cœnogenesis.* The causes of the change from palingenesis to cœnogenesis, he regards as three, viz.: acceleration, retardation, and heterotopy.

It is clear that the two types of growth distinguished by Prof. Haeckel are those which had been pointed out by Prof. Cope in "The Origin of Genera," as producing the relations of "exact" and "inexact parallelism;" and that his explanation of the origin of

the latter relation by acceleration or retardation is the same as that of the latter essay. The importance which he attaches to the subject was a source of gratification to the speaker, as it was a similar impression that led to the publication of "The Origin of Genera" in 1869.

It remains to observe that the phenomena of exact parallelism or palingenesis, are quite as necessarily accounted for on the principle of acceleration or retardation, as are those of inexact parallelism or cœnogenesis. Were all parts of the organism accelerated or retarded at a like rate, the relation of exact parallelism would never be disturbed; while the inexactitude of the parallelism will depend on the number of variations in the rate of growth of different organs of the individual, with additions introduced from time to time. Hence it may be laid down, that *synchronous acceleration* or *retardation* produces exact parallelism, and *heterochronous acceleration* or *retardation*, produces inexact parallelism.

In conclusion, it may be added that acceleration of the segmentation, the protoplasma or animal portion of the primordial egg, or retardation of segmentation of the deutoplasma or vegetative half of the egg, or both, or the same relation between the growth of the circumference and centre of the egg, has given rise to the four types which the segmentation now presents.

An analysis of the laws of evolution may be tabulated as follows:—

		Palingenesis, which is *synchronous*....	*Exact parallelism*, the product of	*Inexact parallelism*, the product of *Cœnogenesis*, which is *heterochronous*....
acceleration, which proceeds by	Exact repetition.....	*		*
	Modified repetition	*		*
	Heterotopy	*		*
retardation, which proceeds by	Exact atrophy	*		*
	Inexact atrophy (or senility)[1]..	*		*

A Human Skull exhibiting unusual Features.—Dr. ALLEN exhibited a human skull showing a number of peculiarities. The most conspicuous of these was a large bridge-like process of bone extending backward from the base of the pterygoid process and adjoining the under surface of the sphenoid bone in front of the foramen spinosum. It was symmetrical, and visible through the foramen ovale, from within the brain-case.

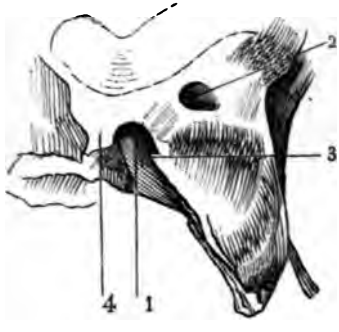
Variations in this portion of the skull are frequent.

[1] So called by Professor Hyatt.

The posterior edge of the outer pterygoid plate is exceedingly variable. A small process (3) is often seen jutting backward from the border of the outer plate on a level with the end of the spinous process. Several specimens in the collection exhibit a bridge formed by this process uniting with the spinous process.

That the variation in the skull under consideration is not of this kind is proved by the specimen exhibiting this process, which for the need of distinguishing it from the other may be called the *accessory process.*

The foramen (2) caused by the bridge-like process opens without in the zygomatic fossa, and within at the anterior border of the foramen ovale. It probably carried a large branch—the motor trunk—of the inferior maxillary division of the fifth cranial nerve.



1. Oval foramen. 2. Abnormal foramen. 3. Accessory process. 4. Spinous process.

Among other peculiarities of the same specimen may be mentioned a duplication of the foramen spinosum of the right side; the almost oval shape of the sphenoidal fissure; the presence of several island-like patches of the upper surface of the greater wing of the sphenoid bone through openings in the orbital plates of the frontal bone; the exceedingly bold sculpturing of the inner layer of the brain case; the great thinning of the wall at the temporal fossæ; pronounced depression for the cartilaginous portion of the Eustachian tube, and two slit-like infra-orbital foramina. The latter are situated five lines below the orbit, and associated with a canal extending outward and backward. The infra-orbital canal is eight lines long.

With all these peculiarities the muscular impressions are weak; the mastoid processes of ordinary proportions, and the styloid processes very small.

Dr. Allen concluded that the inner or *true* cranial plate had been *over*-developed. The outer plate remained nearly the same, excepting at the base of the pterygoid process.

Variations in the skull can be arranged in three groups. (1) Those peculiar to modification in the form of the entire skull, due to arrests or excesses in development. (2) Those due to plus development of the inner or true plate. (3) Those due to traction of muscles. This latter causes no change on the inner plate, unless the error occurs at an early age. Ordinarily, muscular action affects the *outer* plate of the skull only.

FEBRUARY 29.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-nine members present.

The meeting having adjourned until March 7, the following were then elected members:—

Jesse W. Starr, Crozer Griffith, James H. Windrim, Wm. Harris Kneass, Chas. Wilt, Howard Spencer, Thomas S. Root, Jas. W. McAllister, James Ridings, Horace F. Jayne, George Biddle, Geo. B. Dixon, James H. Ridings, Charles A. Blake, Robt. Wood, John Meichel, Wm. S. Pine, Wm. L. Abbot, and J. Sergeant Price.

M. Alphonse Pinart, of Paris, and Edward T. Stevens, of Salisbury, England, were elected correspondents.

The committees to which they had been referred recommended the following papers to be published:—

DESCRIPTION OF A NEW GENERIC TYPE (BASSARICYON) OF PROCYONIDÆ FROM COSTA RICA.

BY J. A. ALLEN.

The large collection of skulls and skins gathered by Professor W. M. Gabb during his scientific survey of Costa Rica, and now deposited in the National Museum at Washington, includes an undescribed species of *Procyonidæ*. This species forms also a new generic type, and, furthermore, one which differs so widely from the forms previously known as to warrant its consideration as the type of a new sub-family, it being as unlike *Nasua* or *Procyon* as these genera are unlike each other. The new form is at present represented in the collection by only a single skull (Nat. Mus. No. 14,214), the skin that came with it (Nat. Mus. No. 12,237) having in some way been mislaid. The skull is that of a rather aged individual, as shown by the obliteration of nearly all of the sutures, and the somewhat worn state of the teeth, but is in excellent condition with the exception of the loss of a few of the teeth.

The outline of the skull in profile (plate 1, fig. 1) is much as in *Procyon*, but the anterior portion is more depressed and is relatively shorter and narrower; the postorbital processes, however, are much more developed, as much so as in *Bassaris* or *Felis*, and the temporal ridges are widely separated, even in old age. As seen from above, the skull has quite a resemblance to that of *Bassaris*, especially in the large size of the orbits, the strongly developed postorbital processes, and the wide interval between the temporal ridges, in all these points resembling *Bassaris* far more than either *Nasua* or *Procyon*, its really nearest affines. The auditory bullæ also differ widely in form and position from those of either *Nasua* or *Procyon*, presenting in some respects features that are exceptional among the carnivora. One of the most important characters, however, of the new type consists in the form of the malar bone, which is greatly depressed and expands abruptly outward in a nearly horizontal plane from the alveolar border of the maxilla, thus forming a nearly horizontal, triangular expansion beneath the orbit—a feature not possessed by any of its nearest affines, and only approximated in *Bassaris* and in the cats. This

results in giving a breadth to the skull at the anterior end of the zygomatic arch but little less than that at its posterior end, at which point the skull has its maximum width. The orbits are relatively twice the size of those of *Procyon*, and being directed considerably forward, give to the skull a quite cat-like aspect. In consequence of the low origin of the malar bone, the small infra-orbital foramen is placed very low, scarcely more than its breadth above the alveolar border of the maxilla.

In respect to other features, the dentition is much as in *Procyon* and *Nasua* $\left(\text{M. } \frac{6}{6}\ \text{C. } \frac{1}{1}\ \text{I. } \frac{3}{3} = \frac{20}{20} = 40\right)$. The canines, however, are smaller than in *Nasua*, and the molars are shorter and more nearly square than in either this genus or *Procyon*, as shown by the subjoined table of measurements:—

		Length.	Width.
Bassaricyon Gabbii,	1st upper molar . .	0.15	0.17
Nasua Sumichrasti,	" " " . .	.30	.27
Procyon "Hernandezii,"	" " " . .	.34	.35
Bassaricyon Gabbii,	2d upper molar . .	.19	.20
Nasua Sumichrasti,	" " " . .	.33	.30
Procyon "Hernandezii,"	" " " . .	.37	.33
Bassaricyon Gabbii,	3d upper molar . .	.14	.14
Nasua Sumichrasti,	" " " . .	.30	.38
Procyon "Hernandezii,"	" " " . .	.28	.34
Bassaricyon Gabbii,	1st lower molar . .	.15	.13
Nasua Sumichrasti,	" " " . .	.32	.18
Procyon "Hernandezii,"	" " " . .	.28	.18
Bassaricyon Gabbii,	2d lower molar . .	.17	.15
Nasua Sumichrasti,	" " " . .	.37	.20
Procyon "Hernandezii,"	" " " . .	.42	.30
Bassaricyon Gabbii,	3d lower molar . .	.20	.17
Nasua Sumichrasti,	" " " . .	.32	.24
Procyon "Hernandezii,"	" " " . .	.41	.25

In the present species the last upper molar is nearly quadrate with rounded angles; in *Procyon* it is subtriangular, with the inner and posterior outer angles rounded; in *Nasua* it has the same form as in *Procyon*, except that the posterior outer angle is sharp.

The palate is flat, not arched as in *Procyon* and *Nasua*, and well produced posteriorly. The auditory bullæ are greatly swollen posteriorly; depressed and laterally compressed anteriorly. The

basi-occipital margin of the bullæ is deflected inward, so that posteriorly the bullæ converge, just the reverse of what obtains in *Procyon*, in which the bullæ diverge posteriorly, and are most swollen and deflected anteriorly. In *Nasua* the auditory bullæ are placed much as in *Procyon*, but they are more globular, and are well developed anteriorly. The converging of the bullæ posteriorly rarely occurs among the Carnivora. The pterygoid processes are relatively smaller than in *Procyon* and *Nasua;* the paroccipital and mastoid processes are but slightly instead of strongly developed, and the paroccipital are not incurved. The anterior end of the intermaxillæ is more pointed than in *Procyon*, but less so than in *Nasua.*

The lower jaw differs from that of *Procyon* in its straight instead of slightly concave alveolar border, straighter lower border, and more diverging coronoid process. The coronoid process is also nearly straight on the anterior border to its apex, instead of greatly rounded, and is much less hollowed posteriorly. The apex of the coronoid is also pointed, and is situated in a line with its anterior border. The angle of the jaw is also much less developed, and the inferior dental canal opens considerably more posteriorly than in *Procyon.* In most of these points the lower jaw much more closely resembles that of *Nasua* than that of *Procyon.*

The skull indicates an animal as small or smaller than *Bassaris astuta*—decidedly smaller than *Bassaris Sumichrasti*—and hence not more than one-fourth the size of the smallest known form of either *Procyon* or *Nasua*, as indicated by the following table of

Measurements of Skulls of Procyon, Nasua, Bassaris, and Bassaricyon.

	Bassaricyon Gabbii. S. I. No. 14,214.	Nasua leucorhynchus. S. I. No. 14,193.	Procyon cancrivora. S. I. No. 6040.	Procyon "Hernandezii." S. I. No. 14,191.	Bassaris Sumichrasti. S. I. No. 7082.
Total length	3.10	5.53	5.10	4.95	3.42
Length (anterior end of intermaxillæ to occipital condyles)	2.95	5.02	5.00	4.63	3.30
Greatest width	1.95	3.23	3.40	3.35	2.22
Width at mastoid processes	1.33	2.15	2.00	2.80	1.45
Distance between the orbits	.60	1.30	1.05	1.10	.75
Width at orbital processes	1.15	1.75	1.33	1.30	1.28
Length of nasal bones	...	...	1.38	...	...
Width of nasal bones at the middle	.20	...	.53	...	...
Anterior end of intermaxillæ to molars	.83	1.60	1.30	1.35	.83
Anterior end of intermaxillæ to posterior margin of palate	1.73	3.37	3.10	2.97	1.47
Anterior end of intermaxillæ to orbit	.84	2.25	1.50	1.60	1.00
Anterior end of intermaxillæ to orbital processes	1.55	3.00	3.53	2.40	1.72
Width of muzzle at the canines	.67	1.00	1.30	1.15	.67
Width of palate at second molar	.60	.75	.83	.92	.47
Length of upper molar series	.92	1.50	1.60	1.60	1.07
Length of the three true molars	.47	.87	1.10	.97	.63
Length of lower molar series	.95	1.67	1.87	1.70	1.13
Length of the three true molars	.55	1.03	1.26	1.17	.72
Length of lower jaw	2.20	3.82	3.75	3.40	1.37
Height of lower jaw	1.03	1.30	1.65	1.52	1.03

The loss of the skin renders it impossible to now properly characterize the species, but as it is presumably only temporarily mislaid, we hope soon be able to make known its external characters. The large size and position of the orbits, and the large bullæ, seem to indicate an animal of nocturnal habits. It is also evidently rather rare, or very difficult to obtain, since Professor Gabb's collection, which embraces very large series of all the more common species, contains but a single example of this.

For the genus I propose the name *Bassaricyon*, in allusion to its strong resemblance in several features to *Bassaris*, and for the species that of *Gabbii*, in recognition of Professor Gabb's invaluable contributions to our knowledge of the zoology and general natural history of the Republic of Costa Rica. As the species differs more from either *Nasua* or *Procyon* than the latter do from each other, it seems to form a type quite as well entitled to rank as a sub-family of the *Procyonidæ* as do either of the others, and may hence be called *Bassaricyoninæ*.

DESCRIPTION OF A MONSTROSITY.

BY HENRY C. CHAPMAN, M.D.

I am indebted to Dr. James Ogden, of Paoli, Philadelphia, for the opportunity of dissecting the monstrosity, of the general appearance of which the illustration gives a good idea. I learn from the doctor that the father and mother are both colored people. The mother is only 17 years old, and has had one child. The children were born dead. The labor lasted 12 hours, the head of the right child presenting first. There was but one placenta.

As regards their mode of attachment, the children were joined together anteriorly by a common sternum and posteriorly by the ribs, the left ribs of the right child being joined to the right ribs of the left. (In my description the children are supposed to be lying upon their backs.) There were two distinct vertebral columns; the heads and necks were quite separate and freely movable. The right upper and lower extremities of right child and the left upper and lower extremities of left child were normal. The two inner arms seemed to be represented in a rudimentary condition

by a lump growing out of a scapula more or less divided into two. The inner clavicles of the children were united. The bone was found fractured, this being caused no doubt in labor. The inner legs of the children were fused into one, which articulated with the acetabulum formed by the inner innominates. The foot exhibited eight toes. Five of these belonged to the left foot of right child and three to right foot of left child. The pelves were double. The left innominate of right child was fused with the right innominate of left child.

Circulatory Apparatus.—There were two distinct hearts with a sinus between them, which received the innominate veins and opened into the right and left auricles of the heart of the right child and the right auricle of the heart of the left child. The heart of the left child was twice as large as that of the right, the common carotids in both children arose by a single trunk from their respective aortas. The outer subclavians were normal, the inner ones feebly developed. The two aortas were well developed, but there was but one hypogastric artery; this, however, was large, and came off from the aorta of left child. Two pairs of lungs were present.

Alimentary Apparatus.—While there were two distinct stomachs, the two small intestines, however, united twenty-seven inches above the cæcum to form one large intestine, which terminated in a single rectum with one anus. The two livers were continuous, the umbilical vein divided into two branches, one for each liver. The two pancreas' were massed together, but only one spleen was seen.

The Genito-urinary Apparatus.—Four kidneys were found, those of left child lying rather loosely in the abdominal cavity; they exhibited enormous ureters which terminated in a bladder in front of the uterus of the left child. As there was no external opening, their size arose possibly from their chronic dilatation by urine. The kidneys of the right child were found in their normal condition, their ureters terminated in a bladder which was seen lying in front of the uterus of right child. The uterus of the right child terminated in a bifid vagina with two external openings; the uterus of left child was longer and narrower than that of right; its vagina was imperforate. The rectum lay between the two uteri.

Reflection on the Cause of Monstrosities.—It is well known that there are two views offered by physiologists as explanations

of the formation of monstrosities: either they are to be regar
as due to the fusion of two individuals, or the secondary i
vidual is to be considered as having budded from the first.
an argument in favor of this latter view there is instanced
fact of there having been found in one yolk two embryos m
or less united. While the fact is true, the inference that s
embryos have been developed from one germ cannot be dr
until it has been shown that such a yolk has not resulted f
the fusion of two yolks while in the oviducts. As an objection
the former view, it is urged that as the presence of an additio
finger or toe is merely regarded as an exhibition of extra nutriti
a sort of budding, to be consistent an almost perfect second
individual should also be regarded as such, inasmuch as th
exists a gradual series between the very simple malformations
the more complex ones, and further, if an additional finger
example has resulted from the fusion of two individuals, what
become of the rest of the secondary being? It may be answe
that the presence of an extra finger cannot be fairly compa
with that of a secondary system, alimentary, circulatory, etc.,
developed. Again, it is quite conceivable in certain cases that o
a part of a secondary individual should develop and the
atrophy. While not denying that there can be budding from
tain parts, it appears to me that a fact like that just descri
of two intestines fusing into one, with the remaining org
double and fully developed, is more readily understood by s
posing that two individuals have been joined together than t
one has budded from the other. The different pups in a litter
developed from distinct ova. Most authorities consider hun
twins as having the same origin. It seems a natural infere
therefore, that a monstrosity such as I have just described is
result of the union of two individuals in the early stages of
tation.

DESCRIPTION OF NEW SPECIES OF FOSSILS FROM PALEOZOIC ROCKS OF IOWA.

BY CHARLES A. WHITE, M.D.

RADIATA.

ACTINOZOA.

Genus CHÆTETES, Fischer.

Chætetes Muscatinensis (n. s.).

Polypary not usually large or massive, but generally encrusting some object, upon which it attains considerable thickness by concentric layers; cells exceedingly slender, but under a good lens they show their numerous septa and the slight constriction of the cells between them quite distinctly.

This species seems never to become ramose, or even elongated except by encrusting some elongated object; by this habit and the unusual minuteness of the cells it may be distinguished from all other species.

Position and locality.—Devonian strata, near Muscatine, Iowa.

Genus MONTICULIPORA, D'Orbigny.

Monticulipora monticula (n. s.).

Polypary usually consisting of small expanded masses, flat or concave below, convex above, thin at the edges, but the middle portion being thickened and considerably elevated; the upper surface having the papillary elevations peculiar to the genus and the under side sometimes having the appearance of being provided with an epitheca; cells of ordinary size, not radiating from a common centre but extending upward more or less perpendicularly with the plane of the base of the polypary.

The uniformity of habit of this species is its most distinguishing characteristic, and by which it may be readily recognized.

Position and locality.—Devonian strata, Iowa City, Iowa.

Genus LOPHOPHYLLUM, Edward et Hairne.

Lophophyllum expansum (n. s.).

Corallum broadly conical, slightly curved, transverse section subcircular, calyx broad, not deep; rays numerous; septal fos-

sette not very distinct, situated at the convex side of the corallum; columella prominent, laterally flattened so as to form a more or less sharp edge along its crest.

This species is proportionally much broader than usual, and when its interior structure is better known it may possibly be found to belong to the genus *Axophyllum*, but its external characters seem to warrant its reference to *Lophophyllum*.

Height of corallum and diameter of calyx each about two centimetres.

Position and locality.—Keokuk limestone (subcarboniferous), Henry County, Iowa.

ECHINODERMATA.

Genus STROBILOCYSTITES (n. g.).

Body ovoid or subspherical; pectinated apertures forming three inclosed rhombic areas, one on each of the four parts of the body except the posterior part; those of the two lateral parts situated above the middle of the body, and that of the anterior part below the middle; ovarian aperture distinct, situated a little below the summit of the posterior side; the four principal arm-grooves distinct, radiating from the summit as far as, or below, the middle; small secondary arm-grooves extending obliquely downward from each side of the principal grooves, their length and distribution being made irregular by the presence and unsymmetrical position of the pectinated rhombs.

The principal plates are probably similar to those of *Callocystites*, but our examples do not show their shapes distinctly; the secondary plates bordering and near the arm-grooves numerous and small.

Two specimens only of the species representing this genus have been discovered. One of these is very imperfect, and the other, although in a comparatively good state of preservation, does not show clearly the arrangement of all the plates. Enough, however, is shown of its structure to separate it from any described genus. It is also, so far as I am aware, the first cystidian ever found in Devonian rocks, the family having hitherto been regarded as characteristic of Silurian strata.

Strobilocystites Calvini (n. s.).

Body subovoid in form; principal arm-grooves distinct, extending nearly to the base of the body; the two antero-lateral and the

two postero-lateral grooves respectively coalescing before they reach the summit, across which continuous connection is made with all of them by a short groove; the front, and the two lateral parts, of nearly equal width; the posterior part narrower than either of the others, and bearing the ovarian orifice a little below its summit; the pectinated rhombs divided longitudinally by a distinct suture; the rhomb of the left side situated about one-third the height of the body below its summit, the direction of the long diameter being nearly at right angles with the axis of the body, and its length a little more than two-thirds the full width of the side: the rhomb of the right side situated at about the same distance below the summit as that of the left, but its long diameter is nearly vertical and twice as great as its transverse diameter; the rhomb of the front side situated near the base, its long diameter being obliquely transverse with the axis of the body, and its shape and size being similar to that of the left side; secondary plates small, tumid, placed in alternating series along each side of the arm-grooves, and outside of these first rows there are other similar pieces, some of which alternate with the first, but others are more irregularly distributed, all giving the surface a papillose appearance.

Column and appendages unknown.

Height of body eighteen millimetres; transverse diameter thirteen millimetres.

Specific name given in honor of its discoverer, Professor Samuel Calvin of the Iowa State University.

Position and locality.—Devonian strata, Iowa City, Iowa.

Genus **MEGISTOCRINUS**, Owen.

Megistocrinus Farnsworthi (n. s.).

Body below the arms moderately deep, its sides slightly expanded, but broadly convex below, and its immediate base a little concave; dome broadly convex, composed of numerous small tumid pieces, and apparently having a short, sub-central proboscis; arms sixteen, four to each of the postero-lateral, and to the anterior rays, and two to each of the antero-lateral rays; the basal series of pieces moderately large, slightly concave, more than half its diameter covered by the last joint of the column; the anal series of pieces occupying a comparatively broad space; the plates generally, having the proportions, shapes, and arrangement common to the genus; the central portion of all the plates is prominent, or

they have their borders so depressed as to produce the appearance of central prominence to the plates, and of broad sutures between them.

Height of calyx fourteen millimetres; diameter of body at the base of the arms, twenty-seven millimetres.

This species differs from *M. latus* Hall, from rocks of the same age in Iowa, by its smaller size, its tumid plates and depressed sutures, and in having only sixteen arms instead of twenty, as in that species.

Specific name given in honor of Professor P. J. Farnsworth, of the Iowa State University, who first discovered it.

Position and locality.—Devonian strata, Iowa City, Iowa.

MOLLUSCA.

BRACHIOPODA.

Genus **STRICKLANDINIA**, Billings.

Stricklandinia castellana (n. s.).

Shell moderately large, sublenticular, broadly subovate or subcircular in marginal outline; valves almost equally convex.

Dorsal valve usually showing a slightly elevated, indistinctly defined mesial fold, which is quite narrow upon the posterior portion of the valve, but widens toward the front, of adult shells; umbo broadly convex; beak not prominent.

Ventral valve usually having a slight flattening of the antero-median portion, corresponding with the indistinct fold of the other valve; umbo broadly convex; beak not prominent, projecting backward little if any beyond the beak of the other valve; area distinct, narrow, its length less than half the greatest width of the shell.

Surface of both valves marked by numerous, rather coarse, radiating, more or less recurving, angular or sharply rounded plications, of unequal size and separated by spaces of unequal width.

Length and breadth of the largest example discovered, each forty-two millimetres; thickness, both valves together, twenty-one millimetres.

Position and locality.—Niagara limestone, Upper silurian, near Castle Grove, Jones County, Iowa.

CONCHIFERA.

Genus PARACYCLAS, Hall.

Paracyclas Sabini (n. s.).

Shell sublenticular; subcircular or subovate in marginal outline; beaks small, approximate, pointing forward, elevated little if any above that portion of the dorsal margin which lies behind them, but considerably above that portion in front of them; dorsal, posterior and basal margins forming nearly one uniform curve, but the prominent front, which is the narrowest and thinnest part of the shell, has its margin more abruptly rounded; ligament small, slightly prominent, but it is made apparently more prominent by two distinct, moderately deep narrow grooves, one on each side of it, which extend from between the beaks backward, and become obsolete upon the postero-dorsal region; valves broadly and nearly uniformly convex, the surface being marked by ordinary lines and slight undulations of growth.

Length of the most perfect example discovered, seventeen millimetres; height fifteen millimetres; thickness eight millimetres. The proportionate thickness of fully adult shells is usually much greater than that here given.

The specific name is given in honor of Mr. A. H. Sabin, of Mason City, Iowa.

Position and locality.—Devonian strata at Rockford, Floyd County, Iowa.

Genus ALLORISMA, King.

Allorisma Marionensis (n. s.).

Shell small, elongate, ventricose anteriorly, and laterally flattened behind, where it is usually a little broader from base to dorsal margin than the anterior portion is; umbones prominent, elevated; beaks incurved, placed far forward; dorsal margin straight or slightly concave; postero-dorsal margin sloping backward to the posterior extremity, the greatest prominence of which is at, or a little below, midheight of the adult shell; base broadly rounded or straightened about midway where the slight umbonal flattening of each valve meets it.

Surface marked by the ordinary concentric lines and undulations of growth.

Length twenty-eight millimetres; height thirteen millimetres.

A few examples have been obtained that are about one-third larger than that of which the dimensions are here given, but it is an unusually small species.

Position and locality.—St. Louis limestone (subcarboniferous) of Marion and Mahaska Counties, Iowa, where it is sometimes found quite plentiful, in both the calcareous and magnesian layers of that formation.

GASTEROPODA.

Genus BELLEROPHON, Montfort.

Bellerophon Bowmani (n. s.).

Shell small, somewhat flattened vertically; umbilici small, and sometimes nearly or quite closed by the overlapping of the callus-like, slightly reflexed expansion of the postero-lateral portions of the margin of the aperture; volutions broadly convex both laterally and longitudinally; aperture comparatively large, but the external margin is not reflexed or flattened by its expansion; mesial band distinct, slightly raised; mesial notch not deep.

Surface marked by numerous concentric folds which are crossed by revolving raised lines of nearly the same size, giving the surface a neatly cancellated appearance.

Length eight millimetres; breadth of aperture the same; height, lying with its aperture downward upon the table, five millimetres.

Specific name in honor of Mr. S. C. Bowman, of Andalusia, Ill., who first discovered it at that place.

Position and locality.—Devonian strata, New Buffalo, Iowa, and Andalusia, Illinois.

Genus EUOMPHALUS, Sowerby.

Euomphalus Springvalensis (n. s.).

Shell rather large; spine much extended for a species of this genus; volutions six or seven, gradually increasing in size from the apex to the aperture; flattened upon the distal or upper side, regularly and continuously rounded upon the outer and proximal sides, and into the deep umbilicus; aperture nearly circular, its outline being modified only by the slight flattening of the distal side and the short contact of the preceding volution.

Length about five and a half centimetres; breadth of last volu-

tion seven centimetres; diameter of aperture twenty-three millimetres.

Position and locality.—Kinderhook formation (Subcarboniferous), Springvale, Humboldt County, Iowa.

PTEROPODA.

Genus CONULARIA, Miller.

Conularia Molaris (n. s.).

Shell having the ordinary four-sided conical shape, each side having an indistinct very faintly impressed longitudinal line, not placed in the middle of the side but nearer to one angle than the other, each angle having the adjacent lines at equal distances, these distances being of course greater from two of the angles than from the other two. Surface marked by fine, sharply raised, minutely crenulated, transverse lines, which present the convexity of a broad curve toward the front as they cross the sides, but bend very slightly forward at the angles, the grooves of which most of them cross continuously to the adjacent side. These raised lines are at slightly irregular distances apart, the distance being usually a little greater than their own width. A cast of a portion of the interior of the shell shows that the inner surface has also markedly slightly raised lines corresponding with those upon the outer surface, and opposite, instead of alternating with them. In the case of mending a fracture of the shell while the mollusk was living, the lines appear to have never been reproduced.

Position and locality.—Devonian strata, Troy Mills, Linn County, Iowa.

CEPHALOPODA.

Genus CYRTOCERAS, Goldfuss.

Cyrtoceras dictyum (n. s.).

Shell not large, curvature broad; section elliptical, the longer diameter of the ellipse being transverse.

Surface marked by fourteen narrow, longitudinal raised ribs, placed at unequal but symmetrical distances from each other, thus: One at each lateral side, a little exterior to the transverse diameter, where it produces a more or less distinct angularity; six between these on the inner or incurved surface, all nearly equal

distances from each other; and six upon the outer surface. The spaces between these last-named ribs are nearly equal except those between the first two ribs on each side of the central space, which are narrower than any of the others. Crossing these ribs are distinct lines and sharp undulations of growth, which bend backward more or less distinctly between all the ribs, but much more so between the two middle ribs upon the outer surface.

The inflexion is so great at the margin of the aperture as to produce a distinct notch there, resembling that of some species of Bellerophon.

The only portion of this species yet discovered is nearly or quite the whole of the outer chamber; none of the septa being shown, but the surface markings are so peculiar that the species may be readily identified by these alone.

Transverse diameter of the aperture, about four centimeters; the shorter diameter, about three centimeters.

Position and locality.—Devonian strata, Troy Mills, Linn County, Iowa.

ARTICULATA.

VERMES.

Genus **TENTACULITES**, Schlotheim.

Tentaculites Hoyti (n. s.).

Shell moderately large; marked by strong, sharply elevated annulations, separated by spaces considerably greater than their own width; spaces and annulations regularly decreasing in width towards the apex, where they are both minute, and both more nearly equal than at its larger end.

Average length, about fifteen millimeters; diameter of aperture, nearly two millimeters. Specific name given in honor of Mr. B. F. Hoyt.

Position and locality.—Devonian strata, Iowa City, Iowa.

MARCH 7.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-six members present.

A paper entitled "On Pachnolite and Thomsenolite," by Geo. Aug. Koenig, Ph.D., was presented for publication.

On Pre-historic Relics.—Prof. HALDEMAN exhibited some prehistoric antiquities, part of a collection he had recently disinterred from a recess in a cliff at his residence on the Susquehanna. The remains include about 200 fragments of pottery, 150 stone arrow-heads, together with stone chisels, tomahawks, mallets, flake knives, broken pebbles, and chips left from the manufacture of arrows, and fragments of bones of various animals. They occurred in a rich, black mould, thirty inches deep, and from the decomposed condition of some of the arrows and chisels, we may presume that the retreat was occupied for not less than two thousand years, but not within the last two hundred, as no articles of European trade were found, such as glass beads and objects of iron, which occur in the Indian graves of the vicinity, and which could be procured at the mouth of the Susquehanna as early as 1631. The discovery is important from the number of objects found in a definite locality.

MARCH 14.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

Additional Note on the Spanish Moss—Tillandsia usneoides.—Referring to some recent remarks before the Academy, Mr. THOS. MEEHAN said the Tillandsia usneoides was an epiphyte and not a parasite, as stated by Elliott in his botany, and it increased by small pieces blowing from tree to tree, and very rarely by seeds.

In a recent visit to an old orange orchard on the shores of Lake Ponchartrain, seven miles below New Orleans, where the increasing level of the waters of the lake had made a subsoil too wet for the trees, and thus caused a large proportion of them to be in a dead or dying condition, he had had an excellent opportunity to study within eye reach the development and propagation of the Tillandsia. As before stated, nearly all the increase was from the scattered pieces of the plant, which attached itself by twisting of the branches or leaves, and then went on increasing its growth

annually. Here and there on the trees a seed had evidently started a young plant, and it was remarkable to note that these cases were always on the under side of the branches, the young plant growing straight down. As these branches were very smooth, it becomes a problem how the seed attach themselves to this under surface so as to remain and germinate. Some of the young plants which Mr. Meehan exhibited were taken from dead branches, as well as from living ones, showing the plant's true epiphytal character.

On the Age and Origin of certain Quartz Veins.—Prof. PERSIFOR FRAZER, Jr., exhibited a fragment of hornblendic dolerite which was found in York County, intersected by a vein of quartz. The alteration of the former along the planes of contact was indicated by bands of half an inch or more of darker color than the rest of the specimen. Within the vein of quartz are observed many fragments—some of them angular, of nearly the same appearance as the altered portions of dolerite. This occurrence is interesting in view of the light which it throws on the origin of some quartz veins. Had the quartz been thrust up from below in a molten condition (as some geologists have believed possible), its combination with the basic constituents of the neighboring dolerite would have followed as a matter of course. The small fragments would have dissolved in it, and there would have been no sharp line of demarcation between the two rocks.

Even had the gelatinous silica (orthosilicic acid) been maintained at a high temperature during its transition into quartz, it seems almost certain that it would have exerted a considerable chemical action upon the trap, producing compounds richer in silica, while the smaller fragments imbedded in it would have left traces of their former position in colored spots throughout the vein. The infiltration was probably slow, and the solution at a moderate temperature, but chemical action progressed slowly through the contact walls, resulting in their partial alteration.

In connection with this subject he called attention to a paper by Lowthian Bell on the "Whin-Stones," or traps of the north of England (Proc. Royal Soc.), replete with analyses, and in which the author advances hypotheses as to the depths to which alterations of sedimentary strata by intrusive rocks takes place, and as to the volatility of the generally supposed unvolatile substances, which are remarkable, and, from the high authority of Mr. Bell in iron metallurgy, worthy of attention.

Mineralogical Notes.—Dr. GEO. A. KOENIG said, that, having been engaged upon the investigation of the minerals occurring at Magnet Cove, Arkansas, for some time past, he desired to give a preliminary notice of some of his results, reserving the details for a memoir, which he hoped to place before the Academy at a future date. Some of his observations were communicated to the Na-

tional Academy of Science at its last meeting, but have not been published. From a mineral, resembling schorlomite very much as to its physical properties, he obtained in the place of titannic acid a *white oxide*, which differed from the latter in a number of important reactions very considerably. In the fragment analyzed, it was contained to the amount of 30 per centum. However, in this, there is comprised a certain quantity of titannic acid. Owing mostly to the want of material, he had, hitherto, been unable to effect a satisfactory separation. Some of the reactions are so peculiar, that the existence in it of a *new metal* is highly probable. However, the nature of titannic acid itself, with the study of which he was now engaged as a preliminary, is yet so little understood, that he refrained from a positive statement for the present. From the same mineral, from schorlomite, and from garnet, he had been able to separate vanadic acid in amounts varying between 0.5 per cent. and traces. This body was overlooked by the authors who analyzed some of the minerals before. Its presence interferes to some extent with the specific reaction of titannic acid before the blowpipe. Having a strong coloring property, its green color with microcosmic salt in the reducing flame is complementary with the violet color of titannium in the same salt, so that a colorless bead may be obtained, and the presence of the latter metal or of both remains hidden. This was verified by experiment. For the purpose of obtaining the true molecular composition of the light-brown garnet, he had selected a very brilliant and pure crystal of the combination $\infty 0.202.0$ for analysis, reserving a suitable fragment for a microscopic section. He had formed a hypothesis in the course of this examination, about the molecular isomorphism of calcium titannate (perowskite), and calcium iron silicate (garnet), and to prove this, it was necessary to learn the true constitution of the latter molecule. He had obtained in due course, about 6 per cent. of titannic acid, acting very similarly with the problematic oxide, above described. Now it was clear, that this garnet was not a homogeneous compound. The microscopic slide exhibited characters corroborating this assumption. Around an opaque nucleus was found a yellow, transparent substance (garnet) in concentric layers, following the outline of the dodecahedron. The layers separated by dark lines, which dissolved under a high power into a series of opaque particles. The striation resembles the structure of agate. What is the opaque substance? Is it schorlomite (the specific nature of which he doubted), is it perowskite, or is it brookite?

He hoped to be able to answer these questions in time. It was but another instance showing that the results of an analysis from an apparently homogeneous material cannot be utilized for the construction of a trustworthy formula, unless the mineral is examined optically. Those cases are excepted where the atomic ratios are simple, and the affinities untortured.

The death of Joseph H. Dulles was announced.

March 21.

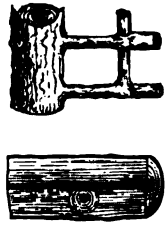
The President, Dr. Ruschenberger, in the chair.

Forty-six members present.

Mastodon andium.—Prof. Leidy directed attention to a specimen consisting of the greater part of the left ramus of the lower jaw of Mastodon andium. It belonged to a mature individual, and contains the last true molar in functional position The penultimate molar had been shed, and its alveoli are partially obliterated. The crown of the retained molar presents four transverse ridges, besides a strong tubercular talon. It measures 7½ inches fore and aft, and 3 transversely. The specimen was obtained by Dr. Isaac T. Coates, of Chester, Pa., from a land slide, at Tarrapota, near the town of Chasuta, on the Huallaga River, a branch of the Amazon, in 7° south latitude.

On Natural Inarching.—Mr. Thomas Meehan remarked that observations on natural inarching among forest trees were common, but now and then were some incidental phenomena worthy of note, an instance of which, on a Hemlock Spruce on the grounds of Amos Little, Esq., of Germantown, was recently brought to his notice.

In this case, a branch had ascended to one above, and appeared to have pierced through it, coming out on the upper side; and the pierced branch, beyond the point of union, had increased to nearly double the size of the part below. The illustration on the black-board was simply from memory, but served to show the position and proportions of the branches. In this case, the upper portion of the seemingly penetrating branch had died soon after the union, and the annual deposits of wood had, of course, in time surrounded it, making it appear very nearly in the centre. The lower portion had continued to live, and all its nutritive collections had gone to feed the branch to which it had become attached. A plant growing in rich soil would make shoots perhaps double the thickness of the same growing in poor soil; in other words, the size of a branch was proportionate to the amount of nutrition at its command. In this case, two branches feeding one main one, gave that branch a double advantage on the score of nutrition, and its increased size naturally followed.



Many strange phenomena reported in the newspapers in connection with natural inarching may, no doubt, be as easily explained, if all the details were correctly reported.

On the Tæniodonta, a new group of Eocene Mammalia.—Prof. COPE described the characters of some mammalia from the Eocene of New Mexico, obtained by him during the Wheeler expedition of 1874, which he regarded as allied to the *Insectivora*. The feet are armed with compressed claws. The dental characters are seen first in the supposed superior incisors. Unfortunately, they have not yet been found in place in the cranium, but their association with a rodent type of inferior incisors, which have been found in place in the mandible, confines us to the alternative choice between superior incisors and canines. From the small size, or absence, of inferior canines, a similar character may be inferred for the superior canines.

These superior incisors present two bands of enamel, an anterior and a posterior. They are compressed in form, the sides presenting a surface of dentine or cementum. Attrition produces a truncate or slightly concave extremity. The inferior incisors are rodent-like.

Two families represented this suborder in the Eocene period in New Mexico. The first, or *Ectoganidæ*, possesses molar teeth with several roots; in the *Calamodontidæ*, each molar has a simple conic fang. But one genus of each family is known. In both the enamel of the molars is principally a band on the outer side of the crown; the deficiency is supplied in *Calamodon* by a deposit of cementum, which invests the molar and superior incisor teeth, covering the crowns, excepting where the enamel bands are present. The latter investment is so much thinner, that the cementum forms a raised border all round at the point of junction of the two substances. The general structure of *Calamodon* affords some points of approximation to the *Edentata*, which indicate that the *Tæniodonta* partially fill the interval between that order and the *Insectivora*, presented by the existing fauna.

Prof. Cope also pointed out the close resemblance between the mandibular dentition of the cotemporary Eocene genus *Esthonyx*, and the existing *Erinaceus*, and stated that that of *Anchippodus* and allies chiefly differs from the latter in the persistent growth of the incisor teeth.

On Tantalite from Yancey County, North Carolina.—Dr. GEO. A. KOENIG spoke of a mineral from Yancey County, North Carolina. It occurs there with beryll, samarskite, columbite, spessartite, and other rare and interesting minerals. It is found in large massive pieces, has a black color and metallic lustre, streak dark reddish brown to black. The specimen in my possession weighs about a pound. It posesses three crystal faces, two of which are at right angles, all three in the same zone. One face is large, smooth, and bright, the other two are rough and uneven, and brown from ferric hydrate. There appears to be an imperfect cleavage parallel to the two faces at right angle. Fracture uneven to sub-conchoidal.

Specific gravity = 5.807 (made with 4.6 grms.) B. B. Infusibl and unaltered. With borax in oxidizing fl. dissolves in larg quantity, and gives a glass which is blood-red when cold (iron manganese). In reducing flame turns green, and when highl charged a blood-red; the same with tin or charcoal. With micro cosmic salt in reducing flame, light brown.

The mineral decomposes readily when fused with about six part of sodium hydrosulphate, the fused mass being yellowish whe cold.

The analysis gave

Metallic acid	= 76.60
FeO	= 14.07
MnO	= 0.50
MgO	= 7.70
	98.87

The metallic acid dissolves in very large quantities in microcosmi salt, and the bead turns brown only upon complete saturation when treated with the reducing flame. From this behavior h surmised the larger portion to be tantalic acid, and the smalle portion to be hyponiobic acid. But in order to satisfy himsel more thoroughly, he converted the acids into the sodium salts by fusing with sodium hydrate. This fusion was extracted repeatedly with cold water. From the liquid the acid was precipitated by dilute sulphuric hydrate filtered under pressure, and the mois precipitate treated with tin and hydrochloric acid to test for dianic acid; a dirty-blue mass was obtained, no blue solution, and th absence of dianic acid was proven. The blue color was due to hyponiobic acid. The larger portion of sodium salt had not been dissolved in cold water, it was dissolved in boiling water and pre cipitated with dilute sulphuric hydrate. The precipitate wa treated with zinc and very dilute sulphuric acid, whence the white metallic acid assumed a pale, bluish-gray color, and is, therefore, tantalic acid. Based upon these reactions, the mineral under ex amination must be pronounced a *tantalite*.

It will be remarked that magnesium forms the principal basis besides iron, and not manganese, as in other tantalites and columbites, and this is, therefore, a distinct and new variety.

He had endeavored to decompose the mineral in a sealed tube under pressure, but failed to do so both with strong and weak acid during several days' treatment. The question whether the iron is ferrous or ferric could not be settled therefore, and in assuming it to be ferrous, he followed the example of the illustrious Heinrich Rose.

Being engaged for the present in other investigations, and aware of Professor Allen's intention to increase our knowledge of these compounds, he refrained from a more thorough examination of the quantitative proportions of the two acids in this mineral.

MARCH 28.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-two members present.

The death of Mr. John S. Phillips was announced.

The following were elected members: John Akhurst, Chas. W. Trotter, Chas. Roberts, Edw. K. Tryon, Edw. Potts, Pierre Munzinger, W. H. Baker, M.D., Rathmell Wilson, Henry Pemberton, J. S. Martin, John T. Lewis, James M. Rhoads, Benj. H. Smith, Edward Tatnall, Jr., John Eckfeldt, M.D., Stuart Wood, and Theodore L. Mead.

Baron Ferd. Von Mueller, of Melbourne, Australia, and Prof. Austin Flint, Jr., M.D., of New York, were elected correspondents.

The committee to which it had been referred recommended the following paper to be published.

ON PACHNOLITE AND THOMSENOLITE.

BY GEORGE AUG. KOENIG, PH.D.

In a very able paper ("Ann. Chem. & Pharm.," vol. cxxvii. 61 1863), A. Knop called the attention of mineralogists to two forms of a mineral, which occurs incrustating the cryolite from Arksud fiord, Greenland. One kind he describes as rectangular parallelopipedic crystals, which are possessed of three perfect, but unequal cleavage directions, parallel to the faces of the crystal, the latter being mostly covered with ferric hydrate. The cleavage directions seemed to coincide with those of the underlying cryolite (identified by quantitative analysis); but an accurate determination of the angles was not possible on account of insufficient reflecting power of the faces. Approximately they were found to be 90°.

The second form of crystals occurs in cavities, whose walls are covered with brilliant, colorless, and transparent crystals.

Both kinds were found chemically identical, and, therefore, belong *to one* mineral, to which Knop gave the very characteristic name, *Pachnolite*—frost stone—from the frost needle-like incrustations covering the cryolite.

From measurements of the small crystals, they were found to belong to the rhombic system, offering combinations of $\infty P.P$; $\infty P.oP.P$; and $\infty P.oP$. The first kind of crystals are of the combination, probably, $oP.\infty\breve{P}\infty.\infty\breve{P}\infty$. The small crystals show a perfect basal cleavage. The angles were found $\infty P : \infty P = 81°24$—98°36′ (mean of 12 determinations). $P : \infty P = 154°40$ (mean of 5 measurements).

Other angles were deduced by calculation:—

Specific gravity = 2.923.

Composition found in mean

F	= 50.79	: 19	= 2.673	6.202
Al	= 13.14	: 27.5	= 0.477	1.106
Na	= 12.16	: 23	= 0·530	1.206
Ca	= 17.25	: 40	= 0.431	1.000
HO	= 9.60	: 18	= 0.533	1.236
	102.94			

Knop takes the atom Al = 13.75, and Ca = 20, HO = 9, therefore his ratio is

F	Al	Na	Ca	HO
6.20	2.21	1.20	2.00	2.236

and he constructs the formula

$$3\left\{\begin{matrix}\frac{3}{5}\mathrm{Ca}\\ \frac{2}{5}\mathrm{Na}\end{matrix}\right\}\mathrm{F}+\mathrm{Al_2F_3}+2\mathrm{Aq}.$$

This, however, is not a correct deduction, because Ca : Na is not 3 : 2, but much nearer 2 : 1, and the formula must necessarily be

$$\left\{\begin{matrix}\mathrm{Ca_2}\\ \mathrm{Na}\end{matrix}\right\}\mathrm{F_3}+\mathrm{Al_2F_3}+2\mathrm{Aq}.$$

Or, if we introduce the present atomic weights, the formula is

$$\left\{\begin{matrix}\mathrm{Ca}\\ \mathrm{Na}\end{matrix}\right\}\mathrm{F_3}+\mathrm{AlF_3}+\mathrm{Aq}.$$

or the empirical formula

$$\left.\begin{matrix}\mathrm{Al}\\ \mathrm{Ca}\\ \mathrm{Na}\end{matrix}\right\}\mathrm{F_6}+\mathrm{Aq}.$$

It will be seen from the foregoing that, taking the calcium as unit, all the other atoms are too high, and that the analysis adds up to nearly 103.00, which is rather more than the mean from several analyses should be. Considering, however, the nature of the substance, too high a result is explicable, and the formula as deduced by me, being of the greatest simplicity at the same time, may be taken to represent fairly the molecule of *Pachnolite*.

It is to be regretted that Knop does not state whether he used the small brilliant crystals affording the above crystallographic results, or whether he used the larger parallelopipedic crystals, or both. It should never be omitted to describe exactly the material taken for analysis, and how it was selected.

Knop's erroneous formula is admitted into Dana's "Handbook" without challenge.

Hagemann also published an analysis of *Pachnolite* ("Am. Journ." ii. xli. 119), which yields the following atomic ratio:—

F	Al	Na	Ca	H_2O
6.17	0.865	1.200	1.00	1.09.

Ca : Na is nearer 2 : 1 than 3 : 2 (taking Ca = 20) as it is i Knop's analysis, and confirms the above formula.

Professor Dana, in the fifth edition of his "Handbook of Mine alogy," introduces a new species, *Thomsenolite*, which had bee described by Hagemann ("Am. Journ. Sci." ii. xlii. 93) as *Dimetr Pachnolite.*

Hagemann made no crystallographic determinations, excep what may be adduced with the naked eye, and his descriptio coincides with that given by Knop for the variety A of *Pachnolit* the parallelopipedic crystals of the combination $\infty\bar{P}\infty, \infty\breve{P}\infty .oP$

According to Dana, the crystals are monoclinic prisms 89°—91 —$0\wedge1$=92° and 88″.

The faces of the prism are usually striated horizontally, clea age basal, very perfect.

Specific gravity, 2.74–2.76. Lustre vitreous, of a cleavage fac a little pearly, color white or with a reddish tinge.

	Composition.		Na = 1, the ratio is
F	= 50.08	: 19	= 2.63
Al	= 14.27	: 27.5	= 0.515
Ca	= 14.51	: 40	= 0.362
Na	= 7.15	: 23	= 0.311
H_2O	= 9.70	: 18	= 0.54

Taking Na = 0.311 as unit, the atomic ratio becomes

F	Al	Ca	Na	H_2O
8.46	1.656	1.109	1.000	1.740

and reducing to whole atoms, the nearest approach is

$$17 : 3 : 2 : 2 : 3$$

or

$$\left.\begin{matrix} Al_3 \\ Ca_2 \\ Na_2 \end{matrix}\right\} F_{17} + 3Aq.$$

This formula appears improbable from its complexity, and fro the fact that the affinities of fluorine are not satisfied by the metal Dr. Hagemann states the crystals to have been covered with white earthy material (SiO_2?), and accounts for SiO_2 = 2.00 in th analysis.

Whenever a mineral substance is so obviously heterogenous a this one, its analysis should not be considered reliable enough t nce a formula, or form an opinion of molecular composition.

Hagemann's formula

$$2(\tfrac{2}{3}Ca + \tfrac{1}{3}Na)F + Al_2F_3 + 2H_2O$$

is not consistent with the analysis; it is a mere conjecture, as may be seen by comparing with the above atomic ratio.

Having lately obtained a number of specimens from the Greenland cryolite locality, through the Reverend Dr. Beadle, of this city, to whom I herewith express my thanks, I thought it worth the trouble to corroborate the few analyses of these very interesting minerals.

A specimen, agreeing completely in its physical properties with the description of Knop's variety A of pachnolite, was first investigated. The structure of the specimen is very like that of crusts of salt, as they are often obtained by slow evaporation—tabular aggregations of cubes, arranged parallel to each other, and at right angles, leaving interstices between themselves into which the cubic crystals project. The tabular masses have apparently one common cleavage face for all individuals, which is of a decided pearly lustre, as described for Thomsenolite. The faces projecting into the interstices are striated and tapering. The crystals are perfectly colorless for the most part. The basal plane O is well developed in all individuals, but the pyramidal faces 1, 1, are usually suppressed. Some of the projecting prisms carry very small octahedrons, either Chiolite or Ralstonite. In selecting the material for analysis, the greatest care was taken to select only perfectly clear cleavage crystals, on which any admixture might be most easily discovered.

An attempt to measure the angles of cleavage direction proved unsatisfactory; the measurements differed several degrees, but (in most cases) were found to be near 90°.

Spec. grav. = 2.937 (made with 5.6921 grammes); 0.5000 grm. gave—

Al_2O_3 = 0.127
CaO = 0.1176
Na_2SO_4 = 0.1560 (Na = 0.0505)
H_2O = 0.0450

1.0000 grm. gave NaCl = 0.2535 (Na = 0.0997) and MgO = 0.0023.

Al	= 13.74	: 27.5	= 0.496
Ca	= 16.79	: 40	= 0.420
Na	= 10.10	: 23	= 0.44
H_2O	= 9.00	: 18	= 0.50
F	= 50.37	: 19	= 2.63 (by difference)

Taking Ca = 0.42 as unit, the ratio is—

F	Al	Ca	Na	H_2O
6.30	1.17	1.00	1.05	1.30

agreeing to the formula—

$$\left.\begin{matrix}\mathrm{Al}\\ \mathrm{Ca}\\ \mathrm{Na}\end{matrix}\right\}\mathrm{F}_6 + \mathrm{Aq}$$

as deducted from Knop's analysis of Pachnolite.

I selected now another specimen, which contains very brilliant crystals in a druse. I broke the crystals off with a forceps, so as to leave a stump on the matrix to be sure of a thoroughly homogeneous material.

These crystals were very slender, of quadratic section, and gently tapering to a point. The basal plane O seemed entirely suppressed in nearly all the crystals, and the pyramidal faces in many, but the very brilliant faces of the prism were distinctly striated horizontally. Basal cleavage very perfect, with pearly lustre. A series of measurements with specimens about $\frac{1}{8}$ inch long and $\frac{1}{32}$ inch wide gave for the prismatic angles the following figures:—

1	2	3	4
90° 30′	90° 10′	90° 15′	90° 5′
89° 36′	89° 52′	89° 25′	90° 15′
90° 14′	90° 13′	90° 15′	89° 25′
89° 40′	89° 45′	90° 5′	90° 15′

The angles are not very constant, but the deviation from a right angle is very small. The angle of the basal plane with the prism could not be determined to my satisfaction. Considering the tapering forms, it seems impossible to say whether the form is rhombic or monoclinic, or quadratic. The points of all the crystals were colored yellow or brown by ferric hydrate, and some crystals had a light straw-color all through.

Specific gravity = 3.008 (determined with 0.7153 grm. in a pyknometer holding about 2 cub. cent. of water).

0.5000 grm. gave—

Al_2O_3 = 0.1170
CaO = 0.1270
Na_2SO_4 = 0.1575 (Na = 0.0511)
H_2O = 0.0252 (from 0.3075 grm.)

Yielding percentage—

Al	= 12.50	: 27.5	= 0.454
Ca	= 18.14	: 40	= 0.453
Na	= 10.23	: 23	= 0.444
H_2O	= 8.19	: 18	= 0.455
F	= 51.54	: 19	= 2.702
	100.60		

Taking Na = 0.444 as unit, the ratio obtains—

F	Al	Ca	Na	H_2O
6.080	1.042	1.020	1.000	1.030

or—

$$\left.\begin{matrix}\text{Al}\\ \text{Ca}\\ \text{Na}\end{matrix}\right\} F_6 + \text{Aq.}$$

(The fluorine is calculated for the percentages of the metals.)

About the correctness of this formula, and the true molecular composition of the mineral, there can be no longer any doubt in view of the above analytic results.

A mineral occurring in small stalactitic and warty masses which project from parallel walls or partitions made up of a compact mineral. It is colored strongly brown, and shows a velvety lustre. On closer observation the stalactites and warts appear to be aggregations of very minute prismatic needles of strong vitreous lustre. No selection was attempted.

0.5000 grm. gave—

Al_2O_3	= 0.1235
CaO	= 0.1195
Na_2SO_4	= 0.1135 (Na = 0.0367)
H_2O	= 0.047
F_2Ca	= 1.0577 (F = 0.5194) from 1.000 grm.

Yielding percentage—

F	= 51.94	: 19	= 2.734
Al	= 13.16	: 27.5	= 0.478
Ca	= 17.07	: 40	= 0.429
Na	= 7.35	: 23	= 0.320
H_2O	= 9.40	: 18	= 0.525
	98.92		

Taking Ca = .429 as unit, the ratio obtains—

F	Al	Ca	Na	H_2O
6.3	1.11	1.00	0.746	1.22

The sodium is too low in this ratio to admit of anything more than an approximation to the general formula, and I consider this substance as a mixture like the one analyzed by Dr. Hagemann (*l. c.*).

The blowpipe and other general chemical properties I found to be as stated by Knop. In analyzing these substances it is necessary to evaporate the solution in the sulphuric hydrate to dryness, to redissolve by boiling with about 300 cubic centimetres of water slightly acidulated, when all the calcium sulphate will pass into solution.

In separating calcium and aluminum I encountered no difficulty, although the aluminum hydrate is very gelatinous. Filtering under pressure, without washing the precipitate, I found, after redissolving it in HCl and reprecipitating by NH_4HO, but a trace of Ca in the filtrate.

It is necessary, however, to ignite the aluminum oxide on a blast in order to obtain a correct weight. In decomposing the mineral in HCl it dissolves, as in H_2SO_4, to a viscous mass, but a complete elimination of fluorine was not effected even after evaporating with strong acid (to dryness 6 times). The aluminum precipitate contained about one-half of the calcium as fluorid.

As is well known, the determination of fluorine presents a number of difficulties, which render an accurate result very uncertain. Fresenius's method, although capable of yielding reliable results, is nevertheless almost impracticable, from the accumulation of errors by changing weights in the numerous parts of desiccating and absorbing apparatus. I endeavored, therefore, to set the fluorine free as fluorid of hydrogen, and collect the latter in an alkaline solution. This method has been proposed (Rose—Analytical Chem.), but I am not aware whether it was ever practised with natural fluorids. Having a platinum still at my disposal, I thought of testing the applicability to the analysis of the above minerals.

In a first experiment sulphuric hydrate was used to decompose the mineral at a temperature rising gradually to the boiling point of the acid. After 45 minutes, on opening the still and dropping in

water, a strong disengagement of HF took place. In a second experiment one part of hydrate was mixed with one part of water. The distillation proceeded very well, and was only interrupted after the alkaline liquid in the receiver (containing 25 p. c. more of NaHO than was approximately required by the fluorine) turned acid. On opening the still and adding water, no HF was disengaged, and the entire residue from distillation passed into solution when heated with a large quantity of water; hence a complete decomposition of the mineral had taken place, and the acid vapors had carried all HF into the receiver. After neutralizing the liquid in the latter, a solution of $CaCl_2$ was added, containing slightly more than the fluorine would prospectively require, and the liquid heated to boiling. The calcium fluorid coagulated perfectly and filtered very easily. It was twice returned into the capsule and boiled with water to extract all calcium sulphate. The precipitate weighed after ignition 1.0577 grammes.

To the filtrate a solution of sodium carbonate was added in excess and boiled, the precipitate ignited, and extracted with precaution by acetic acid. It weighed 0.0085 after being again ignited. The alkaline filtrate was acidulated and precipitated by $BaCl_2$. Precipitate weighed 0.1580. In order to ascertain the exact quantity of sodium hydrate which had been combined with the acids, an equal volume (30.2 c.c.) was evaporated with HCl. The sodium chlorid weighed 1.7205 grms. $= 0.9117$ Na_2O. But 0.2 c.c. had been used to restore the blue color, and has to be subtracted, giving $0.9117 - 0.0060 = 0.9057$ Na_2O combined with fluorine and sulphuric anhydrate.

We found—

$BaSO_4$ $0.1580 = SO_3 - 0.0542$, requiring

0.0420 Na_2O, hence

$0.9057 - 0.0420 = 0.8637$ Na_2O was combined with fluorine, but $31\ Na_2O : 19\ F = 0.8637 : 0.5230$.

By precipitation was obtained 0.5194 F, a difference of 0.0036.

This result was quite promising. It was obtained with the stalactitic aggregations of pachnolite. But on applying the method to the analysis of the parallelopipedic crystals of pachnolite, I encountered difficulties quite unaccountable. I did not succeed in decomposing the mineral completely, either with one part of sulphuric hydrate and one part of water, or with more dilute acid, or by fusing with $KHSO_4$ in repeated trials and proportions.

I am, however, still confident that the method can be so modified as to be applicable to these fluorids.

Regarding silicium dioxde, which Hagemann found in his analysis, I endeavored to find it, but failed. It was certainly owing to superficial impurity.

Potassium I could separate in traces only.

The determination of water I found to be most satisfactory when I used calcium oxide mixed with the minerals instead of lead oxide. The latter when heated to expel moisture is very apt to be partially converted into sesquioxide, which will at a red heat lose oxygen, and the quantity of water will be found too high.

Conclusions. 1. The mineral analyzed by me is identical in composition with Knop's pachnolite.

2. It is identical in form and physical properties with thomsenolite.

3. The measurements are so uncertain that the true form of the parallelopipedic crystals cannot be deduced, and the form may be explained as Knop did.

4. The mineral measured by Knop and Descloizeau has *perhaps* not been analyzed, since Knop does not describe his material taken for the analysis.

5. From the foregoing it does not seem justified to separate the parallelopipedic forms as a distinct species, and the name pachnolite being very expressive and older, all the forms should be designated as *pachnolite* until further investigation.

I may be permitted to state that I do not intend to discard the crystallographic results of Knop, Dana, and Descloizeaux (the original of the latter's work I am unacquainted with). I should be very glad to obtain the crystals which gave the prismatic angles 98° and 81°, so that we should know whether there are two different molecules with two different forms, or whether there is only one dimorphic molecule. But from the measurements I was able to make, I should be very doubtful of dimorphism.

Note.—While this paper is in press, I find a very recent publication by Professor Wöhler (*Ann. d. Chem. u. Pharm.* vol. clxxx. p. 231), in which he gives an analysis and description of the variety A of pachnolite, and arrives at results closely corresponding to my own.

APRIL 4.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-nine members present.

On the Brains of Fishes.—Prof. BURT G. WILDER, of Cornell University, stated that his investigations on the brains of fishes had three objects: 1. To determine, by careful structural comparison, the extent to which such brains may be homologized with those of the higher vertebrates. 2. To see whether brain characters will enable us to define the limits of the group commonly known as Ganoids. 3. To ascertain how far brain characters, alone or in combination with heart characters, will serve for the characterization of all the more comprehensive subdivisions (classes or sub-classes) of Vertebrates.

During the last century fishes' brains have had at least five different interpretations. Their unsatisfactory nature may be inferred from the fact that Prof. Huxley, who generally clears up difficult subjects, makes no attempt in his Manual of Anatomy of Vertebrates to reconcile the figures and descriptions of fishes' brains either with each other, or with his admirable diagrammatic representation of the brain type, to which the brains of Batrachians, Reptiles, Birds, and Mammals are easily referred. He gives a figure of the brain of a typical Ganoid (*Lepidosteus* or "gar-pike"), but makes no allusion to it in the text.

Prof. Wilder believed that brains can be fully understood only by careful comparison of preparations made from fish *just taken from the water* and hardened in strong alcohol; that there should be several of each typical form, and embryos or young as well as adults; and that, instead of trusting to the outward aspect, the mesial surfaces should be examined and sections made at several points.

Finally, he believed it necessary to keep constantly in mind the typical brain as given by Huxley, and which he then briefly described.

By these methods he had been able, as he believed, for the first time, to find the clue to the homology of the two anterior pairs of lobes of the fish brain with parts of the brain of the higher Vertebrates.

The front pair of lobes have usually, though not always, been called olfactory lobes. In Myzonts or Marsipobranchs (lamprey eels, etc.), in Ganoids and some Teleosts as in the higher Vertebrates they are sessile; but in many Teleosts and most, if not all Selachians (sharks and skates) they are connected by elongated *crura* with the second lobes.

These latter are almost universally called *hemispheres.* Yet the essential features of hemispheres, namely, lateral ventricles and foramina of Monro, have never been found in the second pair of lobes of any fish-like form excepting those of the Dipnoans (*Lepidosiren*, *Protopterus*, and *Ceratodus*, the last just described by Huxley), which seem in most respects more like those of Batrachians than of fishes.[1] The second pair of lobes are either lateral solid laminæ joined below but with the upper borders more or less everted, as in Teleosts and Ganoids, or joined above also so as to inclose a cavity, as in Selachians. In either case the median space must be regarded as a forward continuation of the median or 3d ventricle and the lateral walls as anterior enlargements of the thalami. These enlargements Prof. Wilder proposes to call *prothalami;* in Selachians and some Ganoids they are connected by more or less elongated and depressed *crura thalami* with the optic lobes behind.

From the anterior part of the space between the prothalami and, in Ganoids and Teleosts, apparently in the base of the olfactory lobes, Prof. Wilder had found two openings leading into the cavity of the olfactory lobes. These openings he regarded as foramina of Monro, leading into distinct, though small, lateral ventricles.

He has found them in *Myxine* and *Petromyzon* (Myzonts); *Mustelus*, *Carcharias*, and other Selachians; *Acipenser*, *Polyodon*, *Amia*, and *Lepidosteus* (Ganoids), and *Perca*, *Scomber*, and *Anguilla* among Teleosts.

The true hemisphere of Ganoids may be represented by a raised lip of the foramen of Monro.

In an embryo *Mustelus* the anterior part of the brain is a single large vesicle with thin walls. From each side is a little bud which elongates to become the olfactory crus and lobe. By gradual thickening of the walls especially above, the single large cavity of the prothalamus becomes reduced to the two canals found in the adult brain near the ventral surface, which diverge forward from a median point to become continuous with the ventricles of the olfactory lobes. Prof. Wilder does not feel sure respecting the true hemispheres and the manner of their formation.

In the Teleost brains so far examined the foramina of Monro are much smaller than in the Ganoids; and where long olfactory crura exist they may be wholly obliterated in the adult. But if, as is anticipated, they are present in most Teleosts, then, so far as the brain is concerned, they may be distinguished from Ganoids only by the optic *chiasma* of the latter, as first suggested by Müller. To a careful comparison of the optic nerves in all fishes, therefore, attention should be directed.

[1] Since this paper was presented I have seen the paper of Paul Langerhaus (Untersuchungen über *Petromyzon Planeri* [*branchialis*], Freiburg, 1873), in which is given a figure showing the existence of ventricles in the hemispheres and olfactory lobes of the small lamprey.

The points above mentioned were illustrated by diagrams and specimens, also by tables of a provisional arrangement of vertebrates according to the modifications of the brain and heart.[1]

There is much to be done before fishes' brains can be fully understood. For instance, the brain of *Myxine* has not yet been satisfactorily homologized with that of *Petromyson*.

In conclusion, Prof. Wilder exhibited a *Chimera*, recently obtained through the kindness of Mr. Alexander Agassiz, Curator of the Museum of Comparative Zoology, the brain of which, so far as he had been able to examine it, presented a remarkable combination of characters, intermediate between those of Selachians, Ganoids, and Dipnoans. A full description with figures of the brain of *Chimera*, Prof. Wilder hoped to present to the Academy on a future occasion.

On Spessartite.—Dr. GEORGE AUG. KOENIG placed on record the analysis of *spessartite* from Yancey County, North Carolina. This interesting subspecies of garnet has heretofore been found at Haddam, Conn., as the only American locality. In the new locality it occurs in very large crystals, from six to eight inches long and three to four inches thick. The form is a distorted dodecahedron.

The crystals have a dark, almost black color at the surface, owing to a superficial decomposition, by which black oxide of manganese is formed. But in fragments the color is deep blood-red, turning to reddish-brown in thin plates. The latter are transparent and reveal no admixing mineral. Fracture conchoidal. Hardness nearly $= 7$; gravity $= 4.14$.

B. B. unaltered in oxidizing flame, and fuses to a black vitreous globule in point of blue flame. With borax in oxidizing flame dark blood-red bead, which turns dirty-green in reducing flame. With soda, fuses to a green glass. Hot and concentrated acids attack the powder, which is of a brownish color, but very slowly, and complete decomposition cannot be effected.

The very pure selected fragments yield by analysis—

		Oxygen.		Atoms.	
SiO_2	= 35.80	19.092	19.092	0.599	17.06
Al_2O_3	= 19.06	8.881	11.221	0.188	5.08
Fe_2O_3	= 6.25	2.340		0.035	1.00
MnO	= 28.64	6.351	8.698	0.384	10.97
FeO	= 9.49	2.107		0.132	3.80
MgO	= 0.60	0.240		0.015	
	99.84			O = 2.432	69.7

[1] These with figures and descriptions of the brain of *Lepidosteus* are published in the Proceedings Am. Assoc. for Adv. of Science for 1875.

The oxygen ratio is $RO : R_2O_3 : SiO_2$—
1 : 1.28 : 2.19

and the atomistic formula is—

$$\left.\begin{matrix} \overset{IV}{Si}_{17} \\ \overset{VI}{Al}_2\overset{VI}{Fe} \\ \overset{II}{Mn}_{11}\overset{II}{Fe}_4 \end{matrix}\right\} O_{70}$$

It will be noticed that iron is contained in this garnet, both the ferrous and in the ferric state, while in the analyses on rec the iron is given as being all in the ferrous state. When th analyses were made, the method of decomposing minerals in stro sealed tubes at a high pressure was not known, and the mine cannot be decomposed at the ordinary atmospheric pressure, stated above. In heating the powder for thirty-six hours w acid containing 25 per cent. of sulphuric hydrate at 160° C. succeeded in decomposing all but 7 per cent. The ferrous ox obtained from the solution was then calculated pro rata for undecomposed part, and the above result obtained.

To suppose that the presence of ferric iron is due to incipi alteration would not be justified, since no water was obtained ignition, and the pellucidy of the mineral does not appear i paired. To explain the result of analysis the presence either ferric oxide or manganic oxide must be admitted, which alternat would neither affect the oxygen ratios, nor the atomic compositi

I am indebted to Mr. Clarence Bement of this city for material used in this investigation, and I hereby express thanks for his kindness.

The thanks of the Academy were returned to Dr. James Gilliams for a portrait of the late Jacob Gilliams, one of founders of the Academy, painted by Rothermell.

APRIL 11.

The Rev. E. R. BEADLE in the chair.

Thirty-four members present.

The following papers were presented for publication: "T Genus Pomoxys, Raf." By D. S. Jordan and H. E. Copela "Chemical Notes." By Geo. Hay.

Remarks on Arcella, etc.—Prof. LEIDY remarked that the Rhi pods are so exceedingly polymorphous, that, to say the least them, their specific and generic limits appear less well defi animals. In speaking of the Difflugian Rhizopo

Dr. Wallich expresses the opinion that the whole are referable to a single specific type, and as regards the Foraminifera, Prof. Carpenter observes "whether it will ever be practicable to arrange the multitudinous forms of this group in natural assemblages, whose boundaries shall be capable of strict limitation, is to us by no means certain."

It would seem that the existing Rhizopods, in respect to classification, may be viewed as an epitome of all organic forms in all times, for if all these could be known it would be found that there were no absolute limits defining species or any other of the usual divisions in classification. The study of the Rhizopods is facilitated by determining the more general and striking forms, and viewing the others as transitional or related forms, and we can better communicate the results of our study if the more characteristic forms are named as species or varieties.

In his studies of the fresh-water Rhizopods, of various localities in this country, he had recognized most of the well-marked forms which have been described by European naturalists as pertaining to other parts of the world. Besides these he had detected a number of new forms, which perhaps in future will be found not to be peculiar to this country. As an example, in the published Proceedings of this Academy for 1874, page 226, will be found the description of a species, *Euglypha brunnea*, from New Jersey. Since then the same has been described in the Quarterly Journal, of the Microscopical Society of London for 1876, page 107, by Mr. Archer, under the name of *Euglypha tincta*. Mr. Archer's description applies so closely to the specimens observed by Prof. Leidy in every detail, that he thought he was not mistaken.

Among the usually recognized generic forms, Arcella had occupied his attention. In this genus the animal is provided with a membraneous test, composed of exceedingly minute hexagonal elements, usually of some shade of brown, but colorless in the young condition. The shape of the test is usually that of a greater or lesser portion of a sphere with a circular plane below more or less inverted towards a central circular mouth. The soft part of the animal rarely fills the test, but adheres to its inner surface by threads of the ectosarc. Pseudopods digitiform.

The species or varieties observed are as follows:—

ARCELLA VULGARIS, Ehrenberg.
Difflugia arcella, Wallich; *Arcella hemispherica*, Perty.

This is perhaps the most common form. Test approximating a hemisphere with the base rounded and often more or less projecting. The dome is even or mammillated, or is impressed at the sides with concave shallow pits or angular facets. The inferior surface is more or less funnel-like, and the mouth elevated and circular. Color of the tests, from colorless in the young through all shades of raw sienna to burnt sienna brown. Sarcode colorless. Breadth of test from .06 mm. to .132 mm., height .036 to .08; mouth .02 to .048.

? ARCELLA DISCOIDES, Ehr.

A discoid variety of the former, and nearly as abundant, ha the test of the same form but three or four times the breadth c the height, and with the dome almost constantly convex and ever Mouth large. Measurement of a small colorless one: breadtl .112 mm., height .028; breadth of mouth .04. Measurement of large burnt sienna brown test: breadth .132, height .028; breadt of mouth .048.

Certain discoid specimens from Florida approach those describe by Ehrenberg under the name of *A. peristicta*, from South America They are sub-circular, oval, or irregularly oval, often bent or curve in the shorter diameter; in section concavo-convex, with rounde ends. Mouth large, circular or oval, moderately elevated. Dom convex and even. Test in the vicinity of the mouth with a circl of minute tubercles or pores? Color of test varying as in othe Arcellæ. Sarcode colorless. A test measures .14 mm. broad, .12 wide, and .068 high; with the circular mouth .052 diameter. A second is .16 broad, .144 wide, .064 high, and with the mout .064 broad and .08 wide. A third is .184 broad, .172 wide, an with the mouth .06.

ARCELLA MITRATA.

A variety modified in form from the *A. vulgaris* in the opposit direction of *A. discoides*. Test mostly higher than the breadth a base, inflated above, balloon form, pyriform, mitriform; dom convex, even, or polyhedral with impressed angular faces. Mouth elevated as usual, but with its margin usually crenate and everted Sarcode colorless, attached by many diverging threads of ectosar to the inside of the test. Color of the test, from colorless through all shades of raw and burnt sienna to bistre brown. Abundant and very polymorphous, at Absecom cedar swamps, New Jersey = *Arcella costata*, Ehr. ?

a. Balloon-shaped sub-variety, forming about four-fifths of a sphere and with an even dome. Height to .14 mm., breadth a middle equal to the height, at base .088.

b. Pyriform, polyhedral sub-variety. Height .096, breadth above middle .076, at base .048.

c. Mitriform, polyhedral sub-variety. Smallest: height .08, breadth above middle .084, at base .068. Largest: height .168 breadth above middle .2, at base equal to the height.

ARCELLA DENTATA, Ehr.

A. stellata, Ehr.; *A. stellaris*, *A. Okeni*, and *A. angulosa*, Perty.

Test circular, discoid, usually not so high in relation with the breadth as in *A. vulgaris*. The border is everted, acute and divided into usually from eight to a dozen points; the border and points may also curve more or less upward, and the latter may extend as high as the summit of the test. Dome convex and even or flattened at the summit, or with carinate ridges diverging from the latter to the points of the border.

Breadth from .132 to .184 mm., height .04 to .048.

ARCELLA ARTOCREA.

Test from three to four times the breadth of the height with the margin circular and more or less elevated above the base. Dome convex and usually mammillated. Mouth elevated, central, circular and entire. Color of test, various shades of raw sienna brown; and structure as in other Arcellæ. Sarcode attached by many threads of ectosarc to the inside of the test. Entosarc loaded with chlorophyl balls which appear to be an element of structure.

This singular pie-shaped Arcella with a bright-green sarcode is frequent in a pond at Absecom, New Jersey. Breadth of the test at the rim .16 to .176 mm., at the base .124 to .136; height .04 to .052.

CENTROPYXIS, Stein.

Arcella aculeata and *Difflugia aculeata*, Ehrenberg; *Echinopyxis aculeata*, Claparede and Lachman.

Centropyxis is a nearly allied generic form to Arcella, and is so polymorphous that I have been puzzled to define varieties. The test or basis of the test is membranous, and appears not to exhibit the hexagonal structural elements of that of Arcella. The shape is a modification of that of the latter; the mouth and the summit of the dome being eccentric in opposite directions. The dome varies in degree of prominence and is always convex. The mouth varies in proportionate size, and is more frequently sinuous at the border than completely circular. The test presents all the variations of color presented by *Arcella vulgaris*. It is frequently provided with from two to five or more hollow, conical spines diverging from the wider border or that most distant from the mouth. Sometimes the test is clean or devoid of all adherent matters and appears homogeneous, mostly, however, it is more or less covered with mineral particles. Sometimes it is as completely covered with quartzose particles as an ordinary Difflugia, and frequently it is loaded with larger stones along the deeper border. In some specimens the test appears to be wholly composed of a single species of diatome shells.

I have observed a peculiar point of structure in most tests of *Centropyxis* which appears heretofore to have escaped notice. From the sinuous border of the mouth a number of processes extend upward to the dome. These are expanded at the end, and look as if intended to support the roof of the test, though I have not been able to satisfy myself that they actually reach it. Nor have I been able to ascertain whether the number of processes is constant, but they have appeared to me to vary in number from four to seven. They are not visible looking directly into the mouth of the test, but a glimpse of one or two may be detected when the mouth is aslant as the test is made to turn towards one side. From the usual discoid form of the test it is not easy to retain it in position on edge to conveniently examine the pro-

cesses, and when the test is observed with adherent sand tl cannot be seen at all.

Large spineless tests of Centropyxis, from ditches below city, measure .26 mm. broad, .22 wide, and .08 high; with mouth .1 diameter. Large spinous specimens, from the sa locality, measure .22 broad by .208 wide, with the spines .48 l and the mouth .084.

A Difflugian of the sub-generic character I have indicated un the name of *Nebela* appears related with *Centropyxis*. Brie described, it may be distinguished as follows:—

NEBELA CAUDATA.

Test compressed ovoid, laterally pyriform; mouth termin oval, entire; fundus obtuse and bordered with from four to hollow, linear obtuse appendages. Structure of test apparen chitinous and indistinctly areolated. Sarcode colorless. Leng $\frac{1}{12}$ mm., breadth $\frac{1}{16}$ mm., thickness $\frac{1}{32}$ mm. Living in sphagn of a cedar swamp, at Absecom, New Jersey.

On the Nature of Root Fibres.—Mr. THOMAS MEEHAN remark that two excellent papers had recently appeared on the eccent growth of the annual layers of wood in some plants—one in Proceedings of the Poughkeepsie Natural History Society, the other in the American Naturalist. Reading these, it occur to him that some observations of his on the nature of fibrous ro of plants were not generally known, and might interest the Ac emy.

In regard to the eccentricity of the wood, it was long known observers that the pith of trees was often not in the centre, varied considerably in its approaches to the circumference. In case noted in the paper in the Naturalist, the pith of the poison v was very near the outer edge of the wood, and somewhat elevat forming a little ridge all along the bark. Various theories been offered to account for this extra thickening on one side, none of them, Mr. Meehan thought, accorded with all the kno facts, and he believed the true explanation still awaited some tunate discoverer. The author of the paper in the Poughkeep Proceedings had followed the wood chopper, and found that perfectly erect trees, the pith was exactly in the centre, but trees that leaned a little, as many would from being drawn towa the lightest places in infancy, the extra thickening was always the under side. But in the paper in the Naturalist, the obser showed that in the poison vine, though growing to a perfectly right tree, there was still this remarkable eccentricity, and furth that the degree of this eccentricity varied in the same stem different places, although all in the same ascending line. sloping theory, though supported by a remarkable uniformity figures, could not be correct.

But his remarks had relation chiefly to a suggestion in the

uralist that the rootlets of the poison vine, in some cases referred to by the observer, appeared to be several years old. The fact was that these rootlets were never but one year old, a new set being produced every year. This was the case in the poison vine, the trumpet vine, the English ivy, the Virginia creeper when it sometimes produced them, and amongst others generally in the cases of epiphytal orchids. In this respect they followed the same law as prevailed with fibrils under the ground, and indeed the same law prevailed for the whole system of the tree. We say of the inflorescence, that all its parts are but modified leaves, but this is true of all parts. A whole tree is but a modification of a primordial leaf; the rootlets and the branchlets. The roots and the branches are more or less subject to the same laws that govern leaf structure. Leaves fall annually, unless very favorably situated as regards nutrition. Sometimes, as in some evergreens, the greater part of the leaf is conjoined with the stem, or even becomes an imperfect branch, and in these cases is more permanent. In arbor vitæs, deciduous cypress, and some others, the branchlets and leaves are so closely identified, that the general annual character of the leaves extends to the branchlets, and large numbers drop at the regular fall season. Those which are the most favorably situated as regards nutrition, get through the winter season, and after this become branches, and may live to an indefinite period. The root system is the analogue of that which ascends into the atmosphere, and similar laws prevail. The fibrils are the counterparts of leaves, and die annually; but a few, which are more favorably situated as regards nutrition, manage to live over winter, and then become roots that live to an indefinite period. The rootlets on the stems of the creeping vines are of the same character. Seeming but cellular expansions from the bark, they generally die, but if one get into the decaying portion of a hollow tree, or near rich earth, it is so favorably disposed as regards nutrition, that it will live on and become a root. Cases are on record where English ivy has been cut away at the roots from all connection with the ground, and, having lived, the hasty conclusion was formed, that it was drawing sustenance from the air; but further examinations have shown that in these cases some of the annual rootlets had become true roots, penetrating old mortar, and other congenial matter, and thus lived on and contributed materially to the ivy's support.

It had been suggested that the eccentricity of the wood in the poison vine might be owing to the rootlets coming out on the side next the tree, and in this way favorably affecting that side; but the rootlets of the poison vine come out indiscriminately all round the poison vine branch, and as often on the upper as on the lower side. Besides this, in a branch of the Ampelopsis which he exhibited, covered with these rootlets on every side, and which had been hanging like a rope to a tree for a number of years, the wood was so eccentric that the pith was three-fourths further from

one side than the other. That the protrusion of roots on one s had nothing to do with eccentricity, was also clear from the f that he had examined Symphoria, Wistaria, and many other thi with rooting, creeping branches on the ground, in all of which wood was perfectly concentric.

Notes on two Traps; A Case of Alteration of Earthy Sediments Prof. PERSIFOR FRAZER, Jr., remarked, that, at a previous meeti of the Academy the occurrence of a vein of quartz in a mass dolerite had been described. The specimen has been since cut two by a lapidary in such a manner as to illustrate (1) the cent band of quartz (part of which appears to be hyaline and p anhydrous) inclosing numerous small fragments of the adjoini dolerite. (2) Two bands of darker color than the mass of latter, which appear to form the boundary walls between vein and the dyke which it intersects. (3) A broad margin unaltered dolerite on either side. This specimen is presented the inspection of the Academy.

The whole subject of the origin and true nature of "traps," a the means of distinguishing those which have been cooled fro molten mass from those which are indurated, baked, or alte to crystalline rocks from earthy sediments by the proximity sources of heat, is one yet involved in much obscurity. I h here a specimen of what appears to be a baked sandstone belo ing to the New Red Formation, in which a part of the ma occupying an irregular space in one of its ends, has becom coarsely crystallized syenite. The specimen was obtained fr near Harman's blacksmith shop, in the northern and western p of York County.

Notes on some Palæozoic Limestones.—Prof. PERSIFOR FRAZ Jr., remarked that among the many interesting chemical proble connected with geology is that of the relation of a percentage magnesia to the mode of formation and age of the limestones the world. Not only have some very interesting speculations b made as to the condition of the earth's crust during the prod tion of dolomites (see T. S. Hunt's Chemical and Geologi Essays), but it is easy to see that the subject is capable of v large development.

One of the lines of investigation chief in importance is t influence which dolomitic limestone must exercise on the to graphy of a country. Prof. Lesley has shown that the gra effects of erosion can be explained by the slow solution and struction of the limestones of the earth below water level, with t consequent caving in of the strata which rest on them.

It is easy to see that different kinds of effects would be produc by the rapid waste of pure carbonate of lime and the slower struction of magnesian or dolomitic rocks. And the result

the honeycombing of either of them singly would not resemble that of their combination in separate layers or benches in the manner in which they are so frequently found associated in the great valleys of Silurian and pre-Silurian rocks on the Atlantic border.

As these limestones of the Cumberland and York valleys are more thoroughly investigated, the heterogeneous character of the layers which compose them will be much more clearly evident.

It has been sought to ascertain the horizon of a given stratum in these measures by ascertaining its percentage of magnesia, and, indeed, were any such test reliable, it would be of the greatest importance for the stratigraphical geologist.

With the purpose of submitting to this test as many of the limestones as possible, a selection was made of representatives of the principal beds, whose place in the series has been established by the party of York and Adams. Their names are as follows:—

No. 1 is a sandy limestone from the west branch of Creitz's Creek, in the town of Wrightsville. If the interpretation of the structure given in the Report of Progress of the Party of York and Adams for 1874 is correct, this limestone belongs at or near the base of the "Auroral" series, and immediately upon the chlorite and hydro-mica schists.

No. 2 is a specimen taken from the upper bench of a quarry near Pine Grove Furnace, Cumberland County. It probably represents one of the higher beds of the "Auroral." Upon it was found crystallized calcite containing over 98 per cent. of $Ca'' Co_3$, with hardly a trace of magnesia.

No. 3 is a specimen taken from a lower bench (perhaps 25 feet perpendicular to the measures) of the same quarry.

No. 4 is an example of the white or buff-colored limestones which occur together with the blue limestones often in the same quarry, but, nevertheless, usually exhibiting indications of unconformability with them. These limestones are usually poor in magnesia.

No. 5 is taken from Detweiler's quarry, north of the Columbia Bridge, in Wrightsville. Its position is in all probability midway between the upper and lower benches of the auroral limestone.

No. 6 is taken from Detweiler's quarry, south of Wrightsville, and is (as its analysis shows) a calcareous slate underlying one of the many belts of the formation.

The limestone slates which occur with this one in the foot of the quarry are remarkable for the very large amount of pyrite crystals which they contain. Some of these crystals are half an inch on one edge.

The specific gravity was determined with care.

For this determination the specific gravity bottle was not employed, its mission being considered rather to obtain the density of chemically homogeneous compounds. For determinations of the specific gravity of rocks, coals, etc. etc., whose weight becomes

an important item in their transportation for the great industr
it was believed that the weight of a given bulk could be m
accurately determined without taking especial care to exclude
air with which they are partly filled.

ANALYSIS OF LIMESTONES.

Constituents.	Sandy limestone, west branch of Creitz's Creek. No. 1.	Pine Grove Quarry, upper bench. No. 2.	Pine Grove Quarry, lower bench. No. 3.	White limestone, 100 yards east of Beller's Cross-roads. No. 4.	Detweiler's Quarry, west of Wrightsville. No. 5.	Detweiler's Quarry, south of No
Specific gravity (in lump) .	2.832	2.735	2.731	2.750	2.737	2.
Insoluble siliceous residue .	4.400	12.270	12.000	3.570	0.490	41.
Alumina and ferric oxide .	1.170	1.540	0.450	0.210	1.440	6.
Carbonate of lime . . .	[1]49.920	[2]75.320	81.617	[3]91.580	91.400	43.
Carbonate of magnesia . .	[1]42.980	10.750	6.400	[4]4.110	7.290	6.
Sulphur	0.220	0.120	0.422	0.113	0.003	1.
Sum	98.690	100.000	100.489	99.583	100.623	99.
Undetermined and loss . .	1.31	....	....	....	....	0.
Excess	....	...	0.489	0.417	0.623	..
Metallic iron	0.354	0.698	....	....	0.196	1.
Alumina	0.505	0.541	....	....	1.454	3.

Determinations of the carbonate of lime and magnesia in th
rocks were made independently by Mr. D. McCreath, and are
follows:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No
Calcium carbonate . . .	49.92	73.60	86.39	91.67	91.25	44.
Magnesium carbonate . .	42.98	10.98	6.42	4.11	7.58	8.
Silica	....	....	....	....	0.760	
Some sesquioxide	....	....	....	....	0.196	..

The author is indebted to Dr. Cresson for his courtesy in of
ing him the facilities of his laboratory for this investigation.

As a supplement to this table the following, taken from p.

[1] Determined by Mr. David McCreath.
[2] By loss. 73.6 as determined directly by Mr. D. McCreath.
[3] Mean of two determinations.
[4] Determined by Mr. D. McCreath.
[5] Some sulphide is present, as sulphydric acid is produced when the r
is treated with hydrochloric acid.

of my Report of Progress in the District of York and Adams for 1874.[1]

Limestones.

7. New Red S. S. near Dillsburg, foot of MacWilliams slope.

8. Opposite Allison's Mill, Xenia P. O., York Co.

9. From Shaft No. 5, ¾ mile east from Mont Alto Furnace.

10. Half a mile south of Seitzland, in a cutting of the N. C. R. R. (A calcite very similar to that above described as occurring on the upper bench of the Pine Grove Quarry is found here.)

	VII.	VIII.	IX.	X.
Calcium carbonate	73.18	62.35	77.89	93.87
Magnesium carbonate	4.37	6.33	2.83	0.96
Metallic iron	0.52	5.27	1.33	0.30
Insoluble siliceous residue	21.50	20.06	15.89	4.30
Sum	99.57	94.00	97.94	99.43
Oxygen, organic matter, water, and loss	0.43	6.00	2.06	6.57

APRIL 18.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-four members present.

On the Geologic Age of the Vertebrate Fauna of the Eocene of New Mexico.—Prof. COPE presented a synopsis of the species described from the Eocene of New Mexico, arranged in the following manner:—

MAMMALIA	..	54
Perissodactyla	10	
Amblypoda	9	
Pantodonta	9	
Incertæ sedis	3	
Quadrumana	10	
Prosimiæ	10	
Rodentia	3	
Insectivora	19	
Taeniodonta	4	
Bestiæ	2	
Creodonta	13	
AVES	..	1

[1] These analyses were made by Mr. A. S. McCreath, Chemist of the 2d Geological Survey of Pennsylvania.

REPTILIA	..	24
Crocodilia	7	
Testudinata	15	
Lacertilia	2	
PISCES	..	8
Ginglymodi	2	
Plagiostomi	6	

This total number of eighty-seven species may be considered in two aspects, viz., in regard to their geological position, and their anatomical structure.

As regards the former, it may be observed, that the record preserved in these beds is doubtless more imperfect than that found in many others, owing to various physical conditions. One of these is an evident disturbance of temperature and moisture which they have sustained, perhaps in connection with the volcanic phenomena which played so important a part in New Mexico during the later tertiary times. The fossils are generally found in a fragmentary condition, and often distorted by pressure. The fractures of the surface are often of such a kind as to indicate that the bones have been in a plastic state (see the figures of *Stypolophus hians*) during which the fissures thus created in them have in many instances been filled with a siliceous limestone. This material now presents a rough external surface of great hardness, and sometimes incrusts the teeth in such a way as to render it a difficult matter to expose them. Nodules of the same material abound on the bluffs (see the geological report). Not unfrequently the bones are covered with an incrustation highly charged with the red oxide of iron, and this substance gives its characteristic color to a large percentage of the fossils, the others being generally black or dark brown. The light colors of our miocene beds are almost unknown, and the bones are always much harder than these, or even than the fossils of the Bridger group of Wyoming. These facts, in connection with the reduced number of exposures of the beds, account for the comparatively small number of species obtained, and the feeble representation of certain groups, *e.g.*, the birds, lizards, rodents, etc. Nevertheless a large number of individuals were obtained, and a considerable extent of country explored, and I believe that the synopsis above given is an approximation to an expression of the characteristics of the most abundant types, or, of the relative numerical representation in the fauna of the different genera, orders, etc.

Comparison with the established scale of geological horizons of Europe has established the fact that the beds in question belong to the Eocene category, as I have already shown[1] to be true of the longer-known Bridger beds of Wyoming. It remains to collate them with the numerous subdivisions of that period. The differences between the Wahsatch and Bridger faunæ have been in part

[1] Proceedings American Philosophical Society, 1872, February and July.

pointed out in my Report on the Vertebrate Fossils of New Mexico, 1874,[1] and may be more fully stated as follows:—

1. Divisions found in the Wahsatch beds not yet reported from the Bridger beds. Aves, genus *Diatryma* (allied to *Gastornis*); mammalia, *Tæniodonta; Phenacodus; Coryphodon;*[2] *Meniscotherium;* most species of *Hyracotherium.*

2. Divisions found in the Bridger beds not yet found in the Wahsatch: fishes, *Amiidæ;* reptiles, *Ophidia; Anostira;* mammals, *Mesonychiidæ; Tillodonta; Achænodon; Dinocerata; Palæosyops;* most species of *Hyrachyus.*

The Wahsatch horizon of Wyoming has not yielded so many species of vertebrata as those of New Mexico, but the close resemblance of the two faunæ may be observed in the following list of forms which I obtained at several localities: Fishes, *Siluroids;* mammals, *Hyracotherium*, two species; *Phenacodus; Coryphodon*, two to three species. As is well known, the Wahsatch beds underlie those of the Bridger group, and we therefore look for their European equivalent in the lower part of the series. It has been already pointed out[4] that the absence of *Hyopotamus* and *Anoplotherium*, and allied genera, from the Bridger horizon precludes an identification with the upper Eocene of Europe. The comparison of the Wahsatch fauna with that of the lowest of the three divisions into which Professor Gervais has arranged the European Eocene, shows a remarkably close correspondence. This epoch, the Suessonien of D'Orbigny (Orthrocene, Gervais), includes the marls of Rilly and lignites of Soissons, the Thanet sands, London clays, etc. Fossils from these beds appear to have been no better preserved than those of the Wahsatch beds of the Rocky Mountains, yet some of the genera are identical, and others closely correspondent, as follows:—

Wahsatch.	Suessonien.
Ambloctonus.	*Palæonyctis.*
Hyracotherium.	*Hyracotherium.*
Coryphodon.	*Coryphodon.*
Diatryma.	*Gastornis.*
Lepidosteus.	*Lepidosteus.*

As a point of difference between the beds, may be mentioned the absence of the *Tæniodonta* from the Suessonien, a suborder not yet known out of North America.

The Wahsatch formation includes the Geeen River beds of Hayden, a name which I formerly used for the entire series. It, however, applies properly to the fish shales of Green River, con-

[1] Annual Report of Chief of Engineers, p. 592.

[2] The species described by me as *Bathmodon* constitute a section of this genus, characterized by the absence of tubercle or ridge between the inner cusps of the last lower molar. I do not maintain this section as a distinct genus.

[3] See Report of the U. S. Geol. Surv. Terrs., 4to., ii. p. 33–39.

[4] Ann. Rept. U. S. Geol. Surv. Terrs., 1873 (1874).

taining *Asinecps*, *Clupea*, *Osteoglossum*, etc., which are probably local in their character.

The Bridger formation will then represent on the American continent more nearly than any other, the middle Eocene or Parisien of Cuvier, Brogniart, and Renevier.

The teeth of sharks described in the reports quoted are of uncertain origin. They are associated with oyster shells, and both have the appearance of having been transported; nevertheless some of the mammalian teeth found associated with them have a similarly rolled appearance. It therefore remains uncertain whether the ocean had for a limited time access to the Eocene lake, or whether the shark's teeth and *Ostreæ* were derived from the cretaceous beds which formed its shores. Similar, and in one instance the same species of sharks were found in both formations, the division of the cretaceous being No. 3 and 4 of Hayden.[1]

In conclusion, the classification of the North American Eocene may be represented as follows:—

Formation.	Equivalent.	Locality.	Characteristic Fossils.
Bridger Form.	Middle Eocene.	S. W. Wyoming.	*Palæosyops.* *Tillodonta.* *Dinocerata.*
Wahsatch Form.	Lower Eocene.	N. E. New Mexico, S. W. Wyoming.	*Coryphodon.* *Tæniodonta.* *Phenacodus.* *Diatryma.*

APRIL 25.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-nine members present.

The death of Geo. Washington Smith was announced.

In conformity with Art. III. Chap. V. of the By-Laws, John L. LeConte, Geo. H. Horn, E. T. Cresson, Chas. A. Blake, Wm. S. Pine, John Meichel, Geo. B. Dixon, Horace F. Jayne, Charles Wilt, James Ridings, James H. Ridings, and J. W. McAllister, were constituted the Entomological Section of the Academy of Natural Sciences of Philadelphia.

The meeting having adjourned until May 2, the consideration of certain amendments and additions to the By-Laws was then

[1] The same state of things exists in the siderolitic deposits of the canton of Vaud, Switzerland. Mingled with the mammalian remains are teeth of sharks, of which M. La Harpe remarks that their appearance does not warrant the belief that they have been transported, or are not indigenous to the Eocene fauna.

concluded. The propositions to amend, with the signatures and reasons for the same, together with the report of the council upon said amendments, were read, and Chapters I.–XI., inclusive, and Chapter XVI. were then adopted.

The following were elected members: Oliver Bradin, Geo. A. Piersol, John Wister, Wm. Nelson, Rev. Charles A. Dickey, J. H. C. Simes, M.D., Wm. B. Brewster, M.D., Wm. H. Castle, Robt. Hess, M.D., and Pliny E. Chase.

The committees to which they had been referred recommended the following papers to be published:—

THE GENUS POMOXYS, RAFINESQUE.

BY D. S. JORDAN AND H. E. COPELAND.

Among the fishes sent by Prof. S. A. Forbes from the State Normal University of Illinois to us for examination, were many specimens of Pomoxys, known in the Western States as "Crappie." We have prepared the following review of the species that have been referred to this genus, and append the synonymy for future reference.

The genus was described in 1820 by Rafinesque, page 33 of his *Ichthyologia Ohiensis*, in these words: "Body elliptic, compressed, scaly. Vent anterior. Head scaleless, jaws plaited extensively, roughened by very minute teeth. Gill-cover smooth, scaleless; propercule forked beneath; opercule membranaceous and acute posteriorly. Thoracic fins without appendage, but a spiny ray. One dorsal fin opposite the anal, both with many spiny rays." This description has been accepted as sufficiently accurate by most authors, and the genus adopted. Rafinesque referred to the genus one species, obtained at the Falls of the Ohio, with the following description, drawn undoubtedly from the same specimens that suggested the genus: "Silvery; back olivaceous, with some geminate brown transversal lines; a golden ring at the base of the tail; lateral line straight; dorsal and anal fins with six spiny rays; a marginal black spot behind both fins; tail lobed; lower jaw longer. Length 3 to 6 inches. Diameter equaling three-tenths of the length." He called his species *annularis*.

In the "Report of the Zoölogy of Ohio," Dr. Kirtland described the same fish under the name of *Cichla Storeria*, but dropped this name on information from Dr. Storer that Cuvier and Valenciennes had already described it under the name of *Centrarchus hexacanthus*. We have not seen Kirtland's original description, but in November, 1840, in a report on the "Fishes of the Ohio and its Tributaries," in the "Boston Journal of Natural History," vol. iii. p. 480, he gave a description of the fish, made evidently partly from the specimen in hand, from which a good drawing was made (pl. xix., fig. 2), and partly from the real *hexacanthus* of C. and V., a fish that is now commonly placed in the genus *Hyperistius* of Gill. The localities he mentions show that he supposed *Hyperistius*

and *Pomoxys* to be one fish, if the description was not conclusive. In the "Memoirs of the Am. Acad. of Arts and Sciences," new series, vol. ii., 1846, Dr. Storer, in his "Synopsis of the Fishes of N. A.," p. 290, relying on the truth of the information he had given Kirtland, copied the latter's description, with a brief addition, and used the name *Centrarchus hexacanthus*. He gave data of two specimens, one a *Hyperistius*, and the other a *Pomoxys*. The localities and synonymy quoted referred to *Hyperistius*, *Pomoxys*, and what may have been *Centrarchus irideus*.

In 1854 Professor Agassiz, in "The Fishes of the Tenn. River," p. 4 (of reprint), referred a specimen sent to him from that river, to *Pomoxys annularis* Rafinesque, saying it "agreed fully" with his description, except in wanting the ring at the base of the tail. How Professor Agassiz overlooked the statement that the head and gill-covers are "scaleless," is not easily accounted for by us. There can be no doubt, however, about his course in the event of his recognizing this as an error, for he had then taken the ground, since occupied by all our naturalists, that it is better to eliminate error from a recognizable description than to propose a new genus or species.

In the Zoölogical report in the Pacific Railroad Reports, 1858, vol. x. p. 5, Girard reviewed the genus in his characteristic way. He arranged his material in the following manner, that we give in full to show the confusion into which the synonymy was falling:—

1. Pomoxis sparoides, Grd.
   = Labrus spar, Lac.
   = Centrarchus spar. C. and V.
   = " hexacan. Holb. Ich. S. C., pl. 6, fig. 1.
2. Pomoxis nigromaculatus, Grd.
   = Cantharus nigromac. Le Sueur, fide C. & V.
   = Cichla Storeria, Kirt.
3. Pomoxis annularis, Raf.
   "described, or rather recorded, by Rafinesque."
4. P. nitidus, Grd.
   Pl. ii., figs. 5–8 (new species).

We are not bold enough to tell what this all means, except that *Pomoxis nitidus*, Grd., surely is *Pomoxis annularis*, Raf.

In the "Proc. Ac. Nat. Sc. of Phila.," 1865, p. 64, Professor Gill gave a "Synopsis of the genus Pomoxys, Raf.," "to dissipate the confusion." He cleared away, in a satisfactory manner, the mistakes of his predecessors, coming to the undoubtedly correct

conclusion that but one species of Pomoxys was yet known, calling that *storerius*, for reasons following, and added three new nominal species of his own. Of *storerius* he says: "This species has been quite unfortunate in its nomenclature;" and, "This species was first intelligibly noticed by Dr. Kirtland, who, in the 'Report on the Zoôlogy of Ohio,' introduces it under the name of *Cichla Storeria*;" and "the name *Cichla Storeria* must therefore be accepted as the specific appellation of the species described by Dr. Kirtland if Rafinesque's is deemed unworthy of adoption." As between the *specific* descriptions of Rafinesque and Kirtland, on comparison of a specimen from the Ohio with each, I have no hesitation in saying that Rafinesque's is the better of the two. Without, therefore, resorting to the unanswerable argument that since there is but one species of Pomoxys in the region reported on by the two men, and that, therefore, Rafinesque's specific name must stand on as good footing as his generic name, we retain *annularis* on the ground of its accompaniment by a prior and recognizable description.

In regard to the three new "species," we find by an examination of the specimens from Normal, labelled as from the streams of Central and Southern Illinois, the following data:—

The variation ranges in the dorsal spines from v. to viii.; in the dorsal rays from 14 to 16; in the anal spines from v. to vi.; in the anal rays from 16 to 19; in the scales in the lateral line from 39 to 48. The first dorsal spine goes in the diameter of the eye from 4 to $1\frac{1}{2}$ times; the length of the caudal peduncle is to its height as 19 to 13, or as 16 to 16. Specific characters, based on the number of dorsal spines, the size of the scales, the ratio between the first dorsal spine and the diameter of the eye, or between the height and length of the caudal peduncle, are clearly untenable, falling within the range of individual variation, and therefore *Pomoxys brevicauda*, Gill, *Pomoxys intermedius*, Gill, and *Pomoxys protacanthus*, Gill, fall into the list of synonyms of *Pomoxys annularis*, Rafinesque, it being the only species of Pomoxys now known, unless Hyperistius prove to belong here.

The following is the synonymy of the species, with the localities and common names:—

POMOXYS ANNULARIS, RAFINESQUE.

Crappie (West), New Light (Ky.) Bachelor (Falls of the Ohio).

Pomoxis annularis, Raf. Ich. Oh. 1820, 33. (Falls of the Ohio; Ky.).—Ag. Fish. Tenn. 1854, 4. (Tenn. River.)—Grd. Pac. R. R. Rep. X. 1858, 6.

"*Cantharus nigromaculatus*, Le Sueur, fide C. and V. Hist. Nat. Poiss. III. 1829, 88" (fide Grd.). (Wabash River, where Hyperistius is not found.)

Cichla Storeria, Kirt. Rep. Zoöl. Ohio, 191 (fide Kirt.).

Centrarchus hexacanthus, Kirt. Bost. Journ. Nat. Hist. III., 1840, 480, Pl. XXIX. (plate; desc. in part). (Big Miami River.)—Storer, Mem. Am. Ac., new ser. II., 1846, 290. (in part), (not of Cuv. and Val. fide Gill).

Pomoxis nitidus, Grd. Pac. R. R. Rep. X. 1858, 6 Pl. II., Fig. 5–8. (Houston River, Ky.)

Centrarchus nitidus, Günther, I. 1859, 257.

Pomoxys storerius, Gill, Pr. Phil. Acad. 1865, 64.—Cope, Pr. Am. Philos. Soc. 1870, 251. (Missouri Riv.)—Jordan, Geol. Surv. Ind. 1874, 215. (White River.)

Pomoxys brevicauda, Gill, Pr. Phila. Ac. 1865, 64. (North Grand Riv., Mo.)

Pomoxys intermedius, Gill, Pr. Phila. Ac. 1865, 64.

Pomoxys procanthus, Gill, Pr. Phila. Ac. 1865, 64. (Tarboro, N. C.)

Pomoxys annularis, Jordan, Fishes Ich. Oh.: (Bull. Buff. Soc. Nat. Hist., April, 1876, p. 89); Manual Vertebrates E. U. S. (in press)—Jordan and Copeland, Check-List N. Am. Fresh Water Fishes (in press).

Habitat.—Basin of the Ohio, Illinois, Missouri; probably in all the tributaries of the Mississippi. Not in the great Lakes? In North Carolina (fide Gill).

CHEMICAL NOTES.

BY GEORGE HAY.

I. *On the Decomposition of Stannous Chloride in a Geissler Tube.*

While observing, in company with my friend, Dr. Wm. M. Herron, the spectrum of chloride of tin through a powerful spectroscope of four prisms (Browing's make)—the Geissler's spectrum-tube used for the purpose being illuminated by the spark from a large Ruhmkorff's coil connected to six cells and a Leyden jar and a tin foil condenser, the spark being capable of passing six inches in air—the following facts were noted:—

The constricted portion of the tube became hot—the spectrum became gradually feebler and feebler and ultimately ceased—a vacuum had formed within the tube so perfect that the spark would not pass.

On examining the tube I found a metallic deposit or mirror of extreme thinness, but having the well-known metallic lustre deposited upon the glass at the negative end. The wire inside of the tube at the positive end was tarnished, and had lost its metallic lustre, and was covered with a white though thin incrustation. I too hastily concluded that this was anhydrous proto-chloride of platinum, and thank Dr. Koenig for his communication correcting me, as shall appear anon. I had no time just then to investigate further—hence the mistake.

I have used up the tube in making the following observations:—

Before opening the tube I heated the end containing the mirror and found that it did not sublime.

Cut off the tube half an inch above the film, and noticed that the wire within the tube at this end was fused to a globule of the size of a pin-head adhering to the glass projecting within the tube, through which the wire passed.

Introduced one drop of concentrated hydrochloric acid, and, upon spreading this drop over the film and slightly warming, the film dissolved completely.

Rinsed out the solution with water into a small evaporating basin, and evaporated to a few drops, to concentrate as much as possible and remove the large excess of acid.

Treated one drop in a watch glass with hydrosulphuric acid, and got a few brownish-yellow flakes soluble in potash. Treated another drop in a watch glass with hydrosulphuric acid, and introduced fluid and flakes into a narrow tube closed at one end, and evaporated in an air bath—heated this, but only a little free sulphur sublimed, leaving a few grayish flakes in the bottom of the tube. Chased back the sulphur to the bottom of the tube, and covered it and the minute flakes with powdered dry ferrocyanide of potassium and heated again, but, as might have been expected from former experiment upon original mirror, got no mirror anew. Treated another drop with nitric acid, and got upon evaporation the slightest observable white film insoluble in nitric acid. Chloride of mercury yielded a white opalescence. The quantity of metal was so exceedingly small that, had I not experimented upon single drops, I should have got nothing in the way of a reaction. I got no reaction with gold, owing to the extreme minuteness of the quantity of metal. I do not believe that I could have weighed the quantity of metal composing this delicate mirror, but I did not attempt it. It must be remembered that all the chloride of tin within the tube originally was only a vacuum of its vapor; but it yielded the spectrum of chloride of tin, and it is well known that the spectroscope will yield certain results where ordinary chemical tests fail altogether.

The tarnished wire at the other end of the tube was not fused.

Scraped off a little of the tarnish with a penknife blade into a small watch glass and added one drop of water, but the flakes did not dissolve.

To make sure whether the drop of water mentioned had dissolved any chloride, added a small drop of nitrate of silver solution, but obtained no opalescence.

Scraped off the whole of the white tarnish and digested with a few drops of strong hydrochloric acid, and got thus a clear solution. One drop of this solution treated with hydrosulphuric acid gave no precipitate. Another drop treated with ammonia yielded a few gelatinous-looking flakes soluble in caustic potassa.

This white substance, therefore, appeared to be alumina, but, as in the case of the metal, there was extremely little of it—it had probably been chloride of aluminium, and, with the residual air or perhaps some moisture in the tube, had been converted into the oxide at the high temperature produced by the spark, a tempera-

ture sufficiently high to fuse the wire at the other end unde protecting influence of the mirror already mentioned. W the tube at this end I found the wire consisted of aluminium *outside* of the tube at the same end it consisted of platinum, v had, I suppose, been joined to the aluminium by fusion. Th salt was undoubtedly decomposed by electrolysis even when ing as an attenuated vapor.

II. *On the Solubility of Tin, Arsenic, and Antimony in co trated Nitric Hydrate at* 36° *F.*

The following facts have never, so far as I am aware, been lished, either by myself or by any one else. I have already co nicated to the Academy that the metal tin is soluble in a mi of pure concentrated nitric acid and water in equal vol What I have now to communicate is, that tin forms wit undiluted acid a soluble salt, viz. the proto-nitrate of tin.

The circumstances under which the salt was formed we follows: Into a dry test-tube I poured a small quantity of concentrated nitric acid, and then set the tube containing the afloat in a vessel of water at a temperature of 36° F. Int acid I dropped a fragment of pure tin; it became coated w white substance, and in the course of fifteen minutes was en transformed into this white substance. Several fragments c were added at the above intervals, and all were transformed this white subtance. The action of the acid had now becom decided, although the fluid was still strongly acid, and the con of the tube presented a gelatinous appearance resembling t cently precipitated hydrate of alumina. It seemed dou whether I had not merely obtained the ordinary hydrate o tastannic acid. Upon the addition of about two volumes of the whole of the white substance dissolved to a clear and col fluid, therefore holding the tin in the solution and proving the white substance was not the hydrate of metastannic acid

The solution was tested as follows:—

1st. A portion was boiled and the whole of the dissolved was precipitated as hydrate of metastannic acid.

2d. After neutralizing a portion of the free acid, hydrosulp acid caused the precipitation of proto-sulphide of tin mixed sulphur.

3d. To a portion of the original solution was added solution of chloride of mercury, and in the course of a few hours a white precipitate formed consisting of sub-chloride of mercury.

4th. Chloride of gold gave no precipitate.

5th. Potash solution gave a white precipitate soluble in excess of potash.

6th. A mixture of ferricyanide of potassium and sesquichloride of iron was made, and to this mixture was added a portion of the original solution—the result was the production in a few hours of prussian blue.

These tests were, in my opinion, retarded by the presence of a large excess of nitric acid, and the production of purple of Cassius was altogether prevented by the presence of an excess of this acid. All the other tests were perfectly satisfactory.

To obviate the difficulty occasioned by the presence of a large excess of free nitric acid, a fresh solution was prepared by adding the metal to the acid until the contents of the tube had become thick and pasty, and there appeared to be little or no action going on, the tube being kept, as before, surrounded by water at 36° F.

Water was now added to the pasty mass, but in this instance a not very considerable portion of white substance was left undissolved. The solution was filtered, and to the clear filtrate was added—

1st. Hydrosulphuric acid. This yielded a brown precipitate soluble in solution of potash, and reprecipitated brown on addition of dilute hydrochloric acid.

2d. Potash yielded a white precipitate soluble in excess of potash.

3d. Chloride of gold yielded a beautiful and strong coloration of purple of Cassius after addition of a drop of dilute hydrochloric acid in five minutes, and when the tin solution was not too dilute the purple of Cassius was precipitated at once.

4th. Chloride of mercury yielded a white precipitate of sub-chloride of mercury immediately.

5th. To a mixture of ferricyanide of potassium and sesquichloride of iron, a portion of the clear filtrate was added, and almost immediately prussian blue was formed.

6th. Boiling the original filtrate caused the precipitation of the tin as hydrate of metastannic acid.

The above experiments prove that not only is tin converted into

a soluble salt by concentrated nitric acid, but that proto-nitrat of tin is formed.

Pursuing my investigations still further with regard to th action of nitric acid upon the group of metals usually said to b oxidized, but not dissolved or converted into salts by it, I nex experimented upon antimony.

Into a dry test-tube I poured about 2 c.c. of concentrated nitri acid, and then dropped into the acid about 20 grains of powdere antimony. The tube was immediately set afloat in a vessel c water at 36° F. and allowed to remain for about 12 hours, bein shaken occasionally to diffuse the powder through the acid. A first there appeared to be no change produced, but by and by th fluid became distinctly green, and by the end of 12 hours a strongl green solution was obtained. On decanting this green fluid fro the powdered metal and diluting it with water, a bulky and abu dant white precipitate was produced, showing that a large pr portion of the antimony had been dissolved in the nitric acid, an in this respect it appeared to behave like nitrate of bismuth whe diluted with water. In order to ascertain in what state of con bination the antimony was held, the following experiments wer made.

Tartaric acid was added to the fluid containing the precipitat and it at once dissolved to a colorless fluid.

The fluid was now filtered in order to remove any particles c undissolved metal which might have been decanted.

1st. After neutralizing a portion of the free acid in a portio of the filtrate, a strong solution of hydrosulphuric acid was adde —the result was a bulky, orange-red, unmistakable precipitate c tersulphide of antimony, readily soluble in potash, and reprecip tated from its alkaline solution by dilute hydrochloric acid.

2d. To another portion of the filtrate, potash was added, and white precipitate of teroxide of antimony was obtained soluble i excess.

3d. To the alkaline solution last obtained, nitrate of silver wa added, and there was obtained a jet-black precipitate of suboxid of silver insoluble in excess of ammonia—this being distinctiv of teroxide of antimony.

4th. Neutralized another portion of original filtrate by ammoni to remove free nitric acid, and then acidulated with hydrochlori

Put a drop or two of the solution thus obtained upon

clean surface of platinum, and introduced a fragment of zinc—the result was a dark-brown or black stain of metallic antimony not removable by cold hydrochloric acid, but removable by hot nitric acid.

These four tests show that the original solution contained teroxide of antimony, and, as the solution was obtained by means of nitric acid, the probability is that it was a ternitrate of antimony, for a *large quantity* of the metal was dissolved. The HS precipitate was so bulky as at first almost to fill the test-tube.

The solution of antimony in *nitric acid kept cold* will not bear dilution with water except in presence of tartaric or hydrochloric acid.

Boiling the original green solution gave an abundant white precipitate of antimonic acid accompanied by copious evolution of orange-red fumes. Boiled till the red fumes had disappeared—diluted and filtered—the filtrate did not pass through clear, but on passing twice more through the same filter was obtained a perfectly clear filtrate. This filtrate gave every one of the four tests above-mentioned with the utmost readiness, *i. e.*, it yielded in succession tersulphide of antimony, teroxide of antimony, suboxide of silver, and metallic antimony, and therefore held in solution even after formation and precipitation of antimonic acid by boiling a *large quantity* of teroxide of antimony dissolved in nitric acid, or existing as ternitrate of antimony. In this case no other acid but the nitric had been used.

I now experimented upon arsenic in the same manner, *i. e.*, by keeping the pure metal (not pulverized) for 12 hours in contact with pure concentrated nitric acid at 36° F.

The result was a beautiful transparent green solution of the entire quantity of metal. This solution yielded every one of the tests for arsenic acid.

1st. After reduction by sulphurous acid and partial neutralization, it yielded upon addition of hydrosulphuric acid the tersulphide of arsenic.

2d. After complete neutralization, and addition of sulphide of ammonium, followed by addition of hydrochloric acid, it yielded the pentasulphide of arsenic.

3d. After addition of nitrate of silver and a small quantity of ammonia, it yielded the reddish-brown precipitate of arsenate of silver.

4th. In similar circumstances, *i. e.*, after neutralization by monia and addition of sulphate of copper, it yielded the greer blue precipitate of arsenate of copper.

5th. Neutralized and then mixed with a *large* excess of con trated hydrochloric acid and boiled with a slip of clean copp dark-gray film was deposited on the metal.

6th. Neutralized and added a clear mixture of sulphate magnesia, chloride of ammonium and ammonia, it yielded at c a crystalline precipitate of arsenate of ammonia and magn The original green solution was therefore either simple ars acid or a pentanitrate of arsenic.

The curious fact is here observed that these three met arsenic, antimony, and tin, when treated with cold concentr nitric acid *kept* cold, oxidized in the relation of their several v tilities—arsenic yielding either a *penta*nitrate? or merely ars acid, antimony yielding a *ter*nitrate, and tin a *proto*nitrate; w the other curious fact is also to be observed that on boiling original solutions *all* the arsenic remains in solution, a *consi able portion* of the antimony remains in solution, and *none* or the merest trace of the tin remains in solution.

I ought to have mentioned in my last communication that tin employed was not granulated but only cut by a sharp k from a bar in order to prevent too rapid action of the acid u the metal. I found it necessary on the other hand, to pulv the antimony, as without this the action was hardly visible— arsenic was used in large crystals.

Note upon Mr. Hay's Paper. By GEO. A. KOENIG, Ph.D.

The reaction of nitric hydrate upon arsenic at 36° F. res according to the author, in the exclusive formation of arsenic or arsenic pentoxide. This is not substantiated by his ex ments. He certainly proved the presence of the pentoxide, does not speak of any test for the teroxide, the presence of w does not interfere much with the other reactions. It is a fact known by chemists, that a continued digestion of the teroxi needed with concentrated nitric acid to change it into pentox and some authors state distinctly that arsenic is changed by ni acid both into the teroxide and pentoxide.

Since it is known that by the action of nitric acid upon me

heat is generated, and also that antimony and tin are precipitated by heat from their nitric or other acid solutions, it was not astonishing to find those metals go into and remain in solution, by abstracting the heat with a cooling liquid in such measure as heat was generated.

In the case of tin, dilute nitric acid is known to dissolve it as protoxide, and here the water in the acid prevents the heating; in using concentrated acid and applying a cooling liquid at the outside of the vessel, the conditions remain unchanged, and only the application is different.

MAY 9.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-six members present.

The following papers were presented for publication:—

"Fourth Contribution to the History of Existing Cetacea," Edw. D. Cope.

"Zoological and Biological Methods of Research," by Harri Allen, M.D.

Remarks on Fossils from the Ashley Phosphate Beds.—P LEIDY observed that the so-called phosphate beds of Ash River, South Carolina, were remarkable for the singular adn ture of multitudes of fossils of different ages, from the early tiary period inclusive down to the present epoch. The phosph nodules, for which the beds are explored, appear to have had th origin from the eocene rocks beneath. These have also contribu numerous remains of marine vertebrates especially of squalodo reptiles, and fishes. Mingled in the sand and clay with the ph phatic nodules and bones of eocene animals, are innumer remains of cetaceans, sharks, and other marine animals of perh the middle and later tertiary ages. Added to these are multitu of remains of both marine and terrestrial animals of the quatern period. Pell-mell are found together bones of eocene squ donts, animals related with the whales and seals; hosts of te of the great shark Carcharodon angustidens; myriads of the te of the giant of sharks of the tertiary period, the Carcharo megalodon; bones and teeth of whales and porpoises; and abu ance of remains of elephant, mastodon, megatherium, horse, e and occasionally the rude implements of our more immed ancestors.

From among a collection of fossils, from the Ashley phosph beds, recently submitted to his inspection by Mr. J. M. Glidd of the Pacific Guano Company, the specimens were selected wh lie upon the table. One of these is a well-preserved tooth c Megatherium; another, a characteristic portion of the skull c Manatee; a third, a complete tusk of the Walrus; indicating a further point south for the extension of this animal than had b previously known; fourth, a huge tooth of a cetacean allied to sperm whale, probably the same as those from the crag of Antw ascribed to Dinoziphius. Besides these there are the beaks of th cetaceans of the little known family of the Ziphioids. These porpoise-like animals without teeth in the upper jaw, and usu with but a single pair of teeth in the lower jaw. The beaks c posed of the co-ossified bones of the face are remarkable for th

ivory-like density which probably rendered them available as weapons of defence.

A fourth beak from the same locality, presented by Mr. C. S. Bement, belongs to a different species of the same family. The beaks and some associated fossils will form the subjects of a paper shortly to be presented to the Academy.

The beaks have been referred to species with the following names and brief distinctive characters:—

CHONEZIPHIUS TRACHOPS.—Supra-vomerian canal open. Intermaxillaries co-ossified and forming a crest along the middle of the beak extending to the interval of the prenareal fossæ. Maxillaries with a rugged tract at the upper part of the base of the beak.

CHONEZIPHIUS LIOPS.—Beak proportionately of less length than in the preceding. Supra-vomerian canal and intermaxillaries the same, except that the crest of the latter in front is acute. Maxillaries without the rugged tract at base.

EBOROZIPHIUS COELOPS.—A new genus as well as species. Beak above forming a broad gutter as in Hyperoodon, and not divided by an intermaxillary crest as in the preceding. Maxillaries with prominent lateral crests at base, convex inwardly. Right prenareal fossa occupied by a thick osseous disk. Intermaxillaries co-ossified. Supra-vomerian canal open.

BELEMNOZIPHIUS PROKOPS.—Beak solid, with all traces of the original separation of the constituent bones and the ossified mesethmoid cartilage obliterated.

Fish Remains of the Mesozoic Red Shales.—Prof. LEIDY remarked that the remains of life of any kind were exceedingly rare in the mesozoic red shales which cross our State about fifteen miles north of us. Hence any fossils whatever from these rocks were of interest. The three cycloid fish scales, and a few detached caudal rays, in the fragments of red shale, presented by him this evening, he found on the Perkiomen Railroad, near Yerkes' Station, Montgomery County. One of the scales resembles those described by the late Prof. E. Emmons, under the name of Rabdiolepis elegans, from the mesozoic coal shales of Chatham Co., N. C.

Botanical Correspondence of Zaccheus Collins.—Mr. REDFIELD called the attention of the members to the volume of letters of Zaccheus Collins which had been recently arranged and bound. Mr. Collins was well known in his day as an active philanthropist and as a zealous cultivator of natural science. He was early a member of the American Philosophical Society, was elected a member of the Philadelphia Linnæan Society, in 1809, before this Academy was founded, became a member of our Academy in March, 1815, and was one of its Vice-Presidents at the time of his death in 1831. He devoted himself especially to the sciences of Botany and Mineralogy, and the letters of the most eminent botanists of that time show how highly they valued his know-

ledge, and how eagerly they sought his advice upon all doubtful questions in their science. Mr. Nuttall complimented him—by naming for him the genus *Collinsia*—containing some plants of exquisite beauty, and now represented by eleven North American species, mostly Californian, but of which the earliest known was discovered in the valley of the Ohio.

The volume now before us contains an unbroken series of sixty letters from Rev. Henry Muhlenberg, of Lancaster, to whom American botany has been so much indebted, also a correspondence with his son Fred. Aug. Muhlenberg, in which we find the history of the transfer of the Muhlenberg Herbarium to the American Philosophical Society. There are also numerous letters from Stephen Elliott, author of a sketch of the Botany of South Carolina; from Dr. Jacob Bigelow, author of Florula Bostoniensis, and still surviving; from Dr. Wm. P. C. Barton, author of the Compendium Floræ Philadelphicæ; from Dr. Wm. Baldwin, the talented and lamented young botanist, who died upon Long's Exploring Expedition; from Nuttall, Torrey, Leconte, Sr., and many others well known to the scientific world.

It cannot be expected that these letters of sixty years ago can add any new botanical facts to our stock; but they have great interest as illustrating the early history of botanical science in our land, and as revealing to us the obstacles which the students of that day encountered in the scarcity of books, and in the difficulty of communication.

Mineralogical Notes; Hydrotitanite, a New Mineral.—Dr. GEORGE A. KŒNIG communicated the results of an investigation on a changed *garnet* and a changed *perowskite*, from Magnet Cove, Arkansas. A short time ago he had called the attention of the Academy to the occurrence of opaque nuclei observable in microscopic slides of garnets, in which by analysis 6 per cent. of titanic acid was found. He had obtained recently, through the kindness of Dr. Foote, a fragment of a garnet crystal weighing about three ounces, on which the faces of the dodecahedron are visible, and concentrically a nucleus, contrasting by its bright pitchy lustre with the dirty circumferential part of the crystal. The line of contact is apparently very well defined, but on producing on it a fresh fracture, no difference in color and lustre and no line of division can be seen. The streak of the centre is reddish-gray, that of the circumference light greenish-gray. Starting with the hypothesis of a gradual change from inside towards the outside, or, *vice versa*, a cut was made through the crystal, about parallel with one of the principal planes of symmetry, and thus a slice was obtained half an inch thick; this was divided radially into three sections, and one of these was cut into five parts at equal distances from the centre. On reducing the pieces to powder, each by itself, a very gradual change in color was perceptible from the reddish-gray of the central part to the greenish-

gray of the circumference. 0.5 gr. of each sample was fused with 5 grs. of sodium hydro-sulphate, the solution reduced with hydrogen sulphide, after filtration, diluted to 700 c. c. of volume and boiled. Numbering the samples 1, 2, 3, 4, 5 from centre to circumference, the author obtained precipitates by boiling, of respectively 25.00, 16.2, 9.2, 6.0, and 5.0. These precipitates were titanic acid with normal reactions in numbers 3, 4, and 5; very abnormal in number 1, and less in number 2. The description of the purely chemical investigation into the nature of those abnormal reactions will be reserved for a future memoir.

In order to obtain more light upon the cause of this gradual decrease of titanic acid from centre to circumference, one of the sectors was ground to a microscopic section, which showed a banded structure at the circumference with a few opaque crystalline fragments imbedded, but besides this the material appeared homogeneous, the color only changing from light-brown, very gradually into black opaqueness. Had the banded structure continued to the core, the explanation might be looked for in the growing of the crystal at intervals in solutions of different composition, but the change being so gradual, the author is inclined to believe in a metamorphic action from the centre. The chemical fact that titanic acid does not replace one or two of the constituents, as revealed by further investigation, but that silicon, iron, and calcium diminish in the same proportion as titanic acid increases, speaks in favor of the metamorphosis by intrusion of titanic acid.

The crystals of perowskite, pure octahedrons, or octahedrons modified by the cube, are often found to have yellowish-gray spots much softer than the rest of the mineral, and, in some instances, the whole crystal is composed of the same yellowish-gray substance. The specific gravity of one of these crystals was found to be 3.681; nearly 0.2 less than the fresh mineral. An analysis of the same made with 0.5 gramme, gave the following:—

TiO_2	=	82.82
Fe_2O_3	=	7.76
MgO	=	2.72
CaO	=	0.80
H_2O	=	5.50
Vd		Undetermined, but distinct reaction.
		99.60

By metamorphic action nearly all the calcium and some iron have been removed, and water added. The result is a new mineral for which the name *Hydrotitanite* is herewith proposed if the analysis of more specimens should prove the constancy of the composition.

On the Microscopic Observation of Minute Objects.—Prof. FRAZER remarked, that he desired simply to put on record a thought relating to Helmholtz's now famous establishment of the limit of vision through the microscope. As this limit was determined by half the length of a wave of light and since the wave-lengths of the most refrangible rays of the light spectrum (*i. e.* the violet) are somewhere near the 1-57000th part of an inch, the conclusion was reached that nothing more minute than the 1-114000th part of an inch could be seen. But actinic waves or others of smaller length (of greater refrangibility too) in passing through a substance on which are lines or other markings less than 1-114000th inch apart, may be altered to light waves, and become visible, provided, that the substance through which they pass is capable of fluorescing, *i. e.*, increasing their wave length, and provided the distance apart of the marks to be seen is not less than one-half the wave length of such actinic waves.

The meeting having adjourned until May 16, the following were then elected members of the Council:—

For three years—Edw. S. Whelen, R. S. Kenderdine, M.D., J. H. Redfield, J. G. Hunt, M.D.

For two years—Geo. H. Horn, M.D., Jos. Wharton, Jos. Jeanes, Geo. A. Kœnig.

For one year—Geo. Vaux, J. S. Haines, W. H. Dougherty, Harrison Allen, M.D.

MAY 16.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-four members present.

The "Sleep of Plants" as an Agent in Self-Fertilization.—Mr. THOMAS MEEHAN said that what is popularly known as the "sleep of plants," the closing of some kinds of flowers at nightfall, though a matter within common observation, had not, so far as he was aware, been made a subject of physiological investigation, with the view of ascertaining the value, if any, of this kind of motion in the economy of plant life. He had recently discovered that by means of this peculiar motion the common Claytonia Virginica and some butter-cups were fertilized by their own pollen. The fertilization of these plants had been somewhat of a mystery to him, as, in view of some prevailing theories of cross-fertilization by insect agency, these plants ought not to be self-fertilizers; but from repeated observation he was satisfied that no insects had visited plants that had yet seeded abundantly. Watching the process of fertilization in Claytonia, he found the stamens on

expanding fell back on the petals expanded during daylight. At night, when the flower closed, the petals drew the anthers up in close contact with the pistils. Cross fertilization could be accomplished by insects if they visited the flower, but they did not; and actual fertilization only occurred in this way. In many cases, especially in the advance of the season, the stamens recurve so much as to be in a measure doubled up by the nocturnal motion of the petals. The anthers were not drawn into contact with the stigmas in these cases, and the flowers were barren as the result.

In the Ranunculus bulbosus, our common butter-cup, in the evening following the first day's expansion of the young flower, the immature anthers and the young stigmas would be found covered with pollen grains. The inference would generally be that this had been carried there by insects. But as he had been especially on the lookout for insects as visitors to the butter-cup, and feeling sure that none of any consequenee had been to them, he examined these flowers carefully, and found that on the first expansion of the flower a single outer series of stamens burst their anther-cells simultaneously with the expansion of the flower, and, by contracting the cell-walls, ejected the pollen to the smooth petals, from which it easily fell to the immature anthers and stigmas, when the flower closed for the night.

Knowing that another species of butter-cup, the Ranunculus abortivus, had fixed spreading petals which did not close at night, and which, though with comparatively large nectariferous glands full of a liquid secretion, was wholly neglected by insects, and yet had every flower seeding profusely, he was anxious to find, in view of his other discoveries, how these were fertilized. Visiting a wood after twilight, to ascertain if any nocturnal insects visited them, he found that though the petals did not close at sundown, the slender pedicles drooped, inverting the flower, and in this way the pollen found its way from the petals to the stigmas without any difficulty whatever.

Plants, of course, had peculiar functions to perform, and there were pre-ordained plans and special arrangements through which these functions are exercised. But the workings of plant life are so complicated, that, though we see certain results follow certain movements, we are not always sure that we perceive the great and deeper object aimed at in the order of nature. Hence arose the differences of opinion prevailing in regard to the object of cross fertilization. Some plants had arrangements which seemed to preclude the possibility of self-fertilization, and the assumption followed that nature abhorred close breeding in plants, and specially designed such structures to secure the plant against it. He believed that nature had a deeper purpose, as yet unknown; and chiefly because of just such instances as he had given this evening, where nature could not abhor close breeding, when the result of the "sleep of plants" was most perfect in securing self-fertilization.

MAY 23.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

A paper entitled "Further Notes on Inclusion in Gems, etc.," by Isaac Lea, was presented for publication.

Remarks on Fossils of the Ashley Phosphate Beds.—Prof. LEIDY observed, in continuation of his remarks of the previous meeting, on the extinct animals of the Ashley phosphate beds of South Carolina, that they are remarkable for the multitude of remains they contain of fishes, especially of sharks and rays. Among the former were the giants of their kind, the *Carcharadon megalodon* and *C. angustidens*. A tooth exhibited of the megalodon shark is 5½ inches long and 4½ inches broad at the base. The living white shark, pertaining to the same genus, reaches upwards of 35 feet in length and has teeth 2 inches in length. Supposing the megalodon shark to have reached the same proportions in relation with the size of the fossil teeth, it must have exceeded 70 feet in length, and must have proved the most formidable monster of the ancient ocean.

Another specimen, presented for the inspection of the members, is a knob of bone, such as is found at the root of the tail of the devil-fish, the largest of the existing rays. In the latter, the bone is the only one of the body, and it supports a minute spine, a mere rudiment of the barbed weapon of the sting-ray. Our devil-fish, of which a specimen was once exhibited in Peale's Museum of this city, reaches a breadth of 18 feet with the length about 15 feet. The fossil-bone, though the only thing left to tell the tale of its former possessor, is quite a characteristic specimen. It is of more robust proportions than that of its living representative, and probably indicates an extinct species for which the name of *Ceratoptera unios* was proposed.

Specimens exhibited of the dental armature of the roof and floor of the mouth of eagle-rays were referred to extinct species under the names of *Myliobates magister* and *M. mordax*, the former having been one of the largest of its kind. Similar specimens from the eocene marl beds of Monmouth and Burlington Counties, New Jersey, were refered to species with the names of *Myliobates fastigiatus* and *M. jugosus*.

Prof. Leidy further directed attention to a specimen of the snout of an extinct cetacean, which he had recently observed among ne fossils from the Ashley beds in the Smithsonian collection of vernment Department of the Centennial Exposition, and ad been obligingly loaned to him for description by Mr.

W. P. Blake. The specimen, 2½ feet in length, had the density of ivory, and indicated one of the largest of the little known family of the ziphioid whales. It was referred to a new genus and species with the name of *Proroziphius macrops*.

The other fossils are of the giant sloth, the Megatherium, presented by Mr. George T. Lewis, of this city. These were also found in the Ashley deposits, and are probably the remains of animals which became mired in marshes after the elevation of the Ashley deposits above the ocean level.

Two New Minerals.—Prof. J. LAWRENCE SMITH exhibited specimens of two new minerals. The first is a mammillary coating on the columbic acid minerals from North Carolina. It is white and soft, being a hydrate columbate of yttria with about 15 per cent. of water. Sufficient of the mineral has not been obtained, in a state of purity for a thorough analysis, but there is every prospect that there will be. It is readily found on many of the specimens of Samarskite and Euxenite (which last mineral Prof. Smith has discovered to be a constant associate of Samarskite). No name has yet been given to the mineral, as Prof. Smith prefers to complete the analysis before giving it a name.

He also gave some little historical account of the columbic acid minerals.

Another species for which the name *Daubrêlite* is proposed is an interesting mineral recently discovered by Prof. Smith on the nodule of Troilite existing on the Cohahuida meteoric irons that he has been examining. It is a sulphuret of chromium, is a black shining mineral, with a perfect cleavage in one direction, giving a black powder soluble in nitric acid which solution is of an intense chrome green—and is found to contain sulphuric acid, oxide of chromium, and a little oxide of iron, which last Prof. Smith supposes to come from some Troilite not perfectly separated from the Daubrêlite—as this mineral is found on almost all the nodules of Troilite in that iron.

MAY 30.

The President, Dr. RUSCHENBERGER, in the Chair.

Thirty-eight members present.

Chapters XII., XIII., XIV., and XV. of the Amended By-Laws were adopted.

Article 1, Chap. VIII., was amended by adding after the words "thirteen professors:" "Who shall be appointed and superseded or dismissed only by the affirmative vote of two-thirds of the whole Council."

The meeting having adjourned to June 6th, the following were then elected members:—

Wm. Wharton, Jr., C. H. Cramp, Chas. H. Rogers, A. R. Justice, Edw. P. Borden, Edw. Taylor, J. T. Audenreid, J. S. Helfenstein, Mrs. Gertrude A. Quimby, Henry M. Laing, Maxwell Sommerville, and Chas. A. Slocum, M.D.

Prof. Wentzel Gruber, of St. Petersburg, was elected a correspondent.

On some supposed Lemurine forms of the Eocene Period.—Prof. COPE communicated verbally the following observations:—

I have seen no reason to modify the view originally expressed as to the Quadrumanous affinities of *Anaptomorphus*, but new light has been thrown on the structure of *Tomitherium* and its allies. The fragments of skeletons of two species of this genus (*T. jarrovii* and *T. tutum*) include numerous bones of the tarsus, and these are identical with corresponding parts in the *Creodonta* and different from those of the *Lemuridæ*. The astragalus extends anterior to the shortened calcaneum, and the navicular is short and the cuboid not elongate. The astragalus presents two oblique flat surfaces, one for the internal malleolus, the other for the transverse facet of the tibia. The portions of femur, including the third trochanter, the proximal part of the ulna, and the distal portion of the humerus, are all closely similar to those of the *Creodonta*. The type of *Tomitherium* includes some parts of the skeleton not present in the New Mexican species. Thus the ilium of *T. rostratum*, while furnished with the prominent anterior inferior spine of the *Creodonta*, is flattened towards the crest, and is not angulate on the external face. The femur is furnished with a very elevated third trochanter as in *Chiromys* and *Talpa*, and not low down as in *Creodonta*. The head of the radius is rounder than in *Creodonta*. The skeleton of *Tomitherium* in fact bears strong resemblance to that of *Chiromys*, leaving the skull out of view.

The skeleton of the New Mexican form includes an entocuneiform like that of *Stypolophus hians*, which indicates a non-opposable hallux.

It is apparent that the supposed lemurine *Mammalia* of the type of *Tomitherium*, which have the formula of the molar teeth 4–3, cannot be separated by ordinal distinction from the *Creodonta*. They differ from them, it is true, in their wholly tubercular molar teeth, but relate to them in this as the bears and *Procyomidæ* do to other *Carnivora*. I propose therefore to constitute these a distinct group or suborder, intermediate in position between the *Creodonta* and the *Prosimiæ*, under the name of the *Mesodonta*.

I cannot find characters by which to distinguish this division from the *Insectivora* as an order.

I have applied to this order the name *Insectivora* so as to avoid the creation of a new one. I now think that the latter would have been the better course. The name *Insectivora* has acquired currency as applied to the well-known modern group of that name, and its application to types of such apparent diversity as those now associated under a single head is not a convenience. I therefore propose the name *Bunotheria* for the order, and include under it the suborders, *Creodonta*, *Mesodonta*, *Insectivora*, *Tillodonta*, and *Taeniodonta*. Further investigation will be necessary in order to determine the relations of the *Prosimiæ* to this order.

The committees to which they had been referred recommended the following papers to be published:—

ZOOLOGICAL AND BIOLOGICAL METHODS OF RESEARCH.

BY HARRISON ALLEN, M.D.

The influence of methods of zoology upon biological science has, in some instances, led to confusion of terms. The great or primary principles of life are certainly of deeper significance than the limited and often arbitrary deductions of zoology would lead us to infer. An anatomical process as considered within the range of its own forms, and having no direct reference to the needs of the systematists, often ends without the intervention of any of the hypotheses of evolution; not that they fail to support such hypotheses, but that the anatomist finds the nomenclature adopted by the naturalist to be remote from his purpose.

We propose contrasting a few examples of zoological and biological methods as suggested chiefly by the study of deformations.

These may be freely epitomized as follows: I. The principles of reversion as contrasted with gemmation. II. The terms general and special. III. Teleology as contrasted with morphology. IV. Methods of growth as distinct from typical forms.

I. All monsters are now known to be the results of operation of law. Indeed, we have never advanced from the position taken by Montaigne that "from omniscience nothing but the good, the usual, and the regular proceeds; but we do not discern the disposition and relation."

The variance from the type to which the monster belongs cannot for a moment be compared to the variation from the characters of a known specific or generic formula. Indeed, it is singularly rare to have any portion of a monstrosity recalling the normal relation of parts of any animal congeneric with it. If any one compares, for example, the head of a dolphin with its anterior nares in a position somewhat similar to that of the central cavity in the face of a Cyclops sheep, he will find that the rudimentary nasal bones and the exposed position of the vomer, as well as the extraordinary projection of the maxillary processes in the front of the central opening, all suggest that the Cyclops,

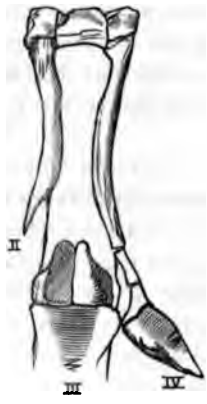
so far as its osseous parts are concerned, is dolphin-like; it will be seen, nevertheless, that the validity of such a comparison is at once dissipated when the intermaxillæ of the dolphin are detected occupying their normal relation to the superior dental arch; while these bones have never descended from the vertex in the Cyclops.

In the same way, the mammal having cleft palate, in which the vomer is seen occupying a position on the plane of the roof of the mouth, is not to be placed in the same group with the Chelonian skull, in which the vomer normally exhibits an exposure in the hard palate, for the reason that this cleft palate is due in the mammal to some error of union between the fronto-nasal process and the related maxillary arches; this—the real cause of the deformation—is not in any way affected in the Chelonian.

It would appear that a lapsus in the course of the development of a highly specialized animal will cause the defect to be fixed at a point so low that no intelligent study can be made between it and the normal "relation and disposition" of parts in another animal equally if not more highly specialized than the one in which the deformation is seen. It is evident that no defect in a ruminant can be said to be a reversion to a cetacean—when the latter is the more specialized of the two animals.

In the same way, great care should be exercised in comparing mammals, exhibiting defects in the numbers of toes, with related zoological types. Starting with the tentative point that the most generalized form of the mammalian limb is a five-toed segmented axis, we have the type to which all other forms can be compared. This comparison is most successfully carried out in the carpus and tarsus. Confining our remarks to the posterior limb, we find the first, second, and third toes uniting through the intervention of the cuneiform bones with the scaphoid, while the fourth and fifth toes unite directly with the cuboid bone. Any descent from this number of five is seen to occur upon the sides, so that the first and fifth toes are lost before the second and fourth; and if the animal possesses but one functionally active toe, it is invariably the third. Reversion, by which any specialized form of foot shows a tendency to return to a more generalized expression, is thought to be exhibited in the horse. A horse having functionally active splint bones would thus suggest a

Fig. 1.



reversion to Hipparion. Mr. Wood-Mason (Proc. Asiatic Soc. Bengal, Jan. 1871, p. 18) has figured (Fig. 1) and described a horse's foot in which one of the splint bones was hoof-bearing.

While accepting the premises by which can be demonstrated the line of descent of the horse from Hipparion, we think that the proof of the argument rests not upon the number of digits, but upon their "disposition and relation." The tarsus is the key to all parts of the foot arranged distally to it. Observers have too often neglected the necessity of tracing supernumerary toes back to their corresponding tarsal elements, thus impairing the force of their conclusions, and confounding a zoological inference (*i. e.*, a reversion of a special to an embryonic form) with another larger principle (*i. e.*, gemmation).

In some of its expressions, at least, reversion and gemmation are terms of equal value; thus, if we look upon the limb as a bud, the toes partake of the same value as the main shaft of the limb, and may be called distal buds—diverging as rays from the tibia and fibula; the mere substitution of the term bud for toe is here of the first importance, for we can thereby account for any number of toes as well as any interference in the order of the bones of the normal foot. Whereas, if we use the term toe instead of bud, we are limited strictly to the foot as determined by its own tarsus, and anything in excess of that number is atypical, and has no zoological equivalent. It is evident that the mere duplication of a "toe" is no proof of its reversion to anything, whether it occur in the horse or in man. Let us suppose, for example, that a child is born with six toes, it does not follow that the sixth toe is an example of reversion, but is a mere expression of an excessive tendency to budding. In like manner, the so-called second hoof of the horse may have no connection with either the fourth or the second toes, but may be a mere bud or graft from the third. (Fig. 2.)

Prof. Leidy (Proc. Acad. of Nat. Science, 1871, 112) has called attention to the foot of a horse in which the splint bone, becoming functionally active, would appear to be an instance of reversion toward Hipparion. A careful examination of this specimen has

convinced the writer that four toes are here present instead of three, and that the first and second are united in a common shaft, bearing a hoof, occupying a position of the functionally active

Fig. 2.

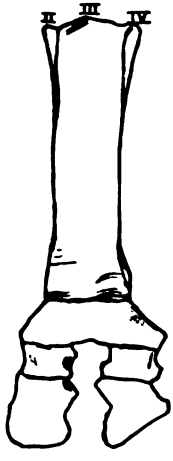
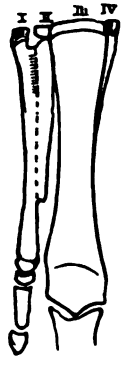


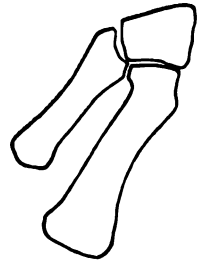
Fig. 3.



splint bone, as in the case recorded by Mason. This specimen cannot be considered, therefore, as a reversion to a three-toed, nor even to a congeneric four-toed ancestor, since the first toe is present. (Fig. 3.)

Fig. 4.

Fig. 5.



Otto (Monstr. Anat. Des.) has figured numbers of examples of six-toed and six-fingered monsters. In some of these the additional digit is a distinct bud from the shaft of a marginal meta-

carpal or metatarsal bone (Ibid., Tab. xxv., Fig. 9). (Fig. 4.) In others the new appendage extends upward to the tarsus (Ibid., Tab. xxv., Fig. 11). (Fig. 5.) We would place the first-mentioned of these in the group of rayed processes of Goodsir; and in the second group we would place those alone whose divergent rays enter directly into the construction of carpus and tarsus respectively. In this restricted sense, reversion is of subordinate value as compared to the principle of budding.

M. S. Arloing (Ann. des Sciences Naturelles, viii., 1867, 55, pl. II.) figures and describes the anterior extremity of a horse, in which the bovine-like hoof is dependent upon an atypical budding from the end of the third toe (see Fig. 2).

In like manner the union of parts usually distinct, as, for example, the produced digits of a hog—forming a solid terminal bone incased in a single hoof—should not even remotely suggest any variation in the type. Such unions are not known to yield corresponding change in the carpus. For figures, see Otto, loc. cit., and Struthers, Edin. Phil. Journal, N. S., 1863, 272.

II. Pursuant to the method as above suggested, the terms general and special, as applied to the limitation of types, can be made to assume a deeper significance. It is accepted that, in the mammalian limb of a five-toed form having the digits of about equal lengths, we have what is accepted to be a generalized "disposition" of parts; but, at the same time, the muscles in a series of limbs so characterized will have varying degrees of specialization. Thus the separation of the deep from the superficial flexor, in the hand of man, creates a high degree of specialization compared with the paw of the opossum, in which the division of the common flexor is barely manifested.

So with the inferior extremity of man we find all the essential elements of the osseous structure of a remarkably low degree of generalization, so far as the parts below the neck of the femur are concerned. But the bone at that point and the hip-bones present an extraordinary degree of special development. Here, then, is a limb found in a highly specialized zoological form, which is specialized only towards its proximal end.

In the arrangement of its muscles, particularly in the posterior femoral group, we get a marked degree of specialization. The muscles which in most animals belong to the extrinsic group, such as the *biceps flexor*, *semi-membranosus*, and *semi-tendinosus*, are

removed entirely from the trunk, and pass between segments of the limb. This arrangement, joined to the excessive development of the *glutæus maximus*, enables man to assume the erect position. The consequences of this assumption are so varied and important as to give the clue to some of his best physical characteristics. It is thus seen that the arrangement of these muscles is of great value, although it need not be taken into consideration if we view the limb, as is commonly done, from the standpoint of the osseous parts only.

III. Now this posterior femoral group of muscles yields an upward prolongation of fascia, which is intimately identified with the *biceps flexor*. This prolongation extends as far as the sacrum, and has received the name of the great sacro-sciatic ligament. Very rarely the *biceps flexor* continues muscular along this tract, thus affording an illustration of reversion. But singularly enough, this reversion is not to the higher quadrumana, where the sacro-sciatic ligament is even less pronounced than in man. Probably we will find the type to which this upward prolongation of the biceps can be located somewhere in the link uniting the lemurs with the rodents. Teleology has been contemptuously regarded. Kitchen Parker has called it "a pretty gilded ball," that lies by the side of the path of severe study, and if it attract attention at all, does it at the expense of true progress. But it will not do to ignore teleology. Here is a group of highly specialized muscles based upon a trifling difference in the arrangement of muscular fibres, which is nevertheless indirectly the cause of retardation or deviation of parts in themselves of great morphic significance.

IV. The several types which have received the names vertebrata, articulata, mollusca, and radiata are no longer considered as expressions of distinct ideas, so much as different expressions of the same idea. The forces of nutrition in all the types are obedient to the same laws. It is evident that it is more interesting to study these laws than the resultant forms. There are no dissonant laws existing in the several types, but a few harmonious laws existing in all.

The law of bilaterality, for example, is seen in all the types. The law of the spiral, the law of gemmation, the laws of conjugation and fissuration are all actively expressed in the tissues.

To these accepted data we may be allowed to add another, viz., the law of radiate nutrition. This is one of the most pronounced

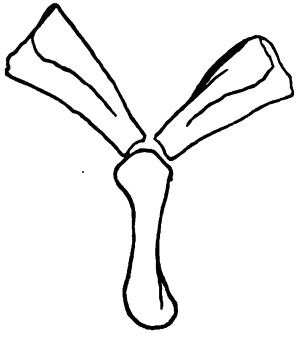
phases of growth force. Numerous examples of radiate skeletons are seen in the Protozoa, where nothing else in the way of formed tissue need be seen. It is, therefore, together with the force of the spiral, among the *first* expressions of growth force. It gives the entire group of the Radiata its most conspicuous superficial character. In the lower Annulosa it operates in more restricted fields, but often so powerfully as to be alone subordinate to the law of bilaterality. In the Mollusks it appears to occupy a position below both bilaterality and the force of the spiral, although in the compound Ascidians we see examples of it, as well as in the minute anatomy of the tests of many bivalves.

We called attention to the existence of a radiated type of nutrition in vertebrates in 1872 (Proc. Acad. Nat. Sci., 1872, 42), and particularly invited attention to the arrangement of the bones of the pelvic and shoulder girdles.

Prof. Theodore Gill[1] has also suggested the identification of homologous parts, from a central or determinate part outwards. Within certain limitations (viz., the acceptance of the limb as a peripheral quantity, potentialized from distal to proximal ends) this view is in harmony with our own.

The law of radiate nutrition which so powerfully impresses the tissues at both the shoulder and pelvis, maintains its authority in the event of deformation. Thus, in a double monster, the right scapula of one individual, the left scapula of the opposite individual (Fig. 6), and a humerus, bearing ulna, radius, and carpus, will be arranged as rays from a central point. It is evidently impossible to identify this humerus and its associated segments with either of the individuals.

Fig. 6.



In another example the parts of the limb were arranged bilaterally. One division represented the distal portion of the right limb of an individual, the other portion of its opposite—the limb gradually ending in the femur as a single struc-

cing this single femur toward the trunk, we found, as

[1] Smithsonian Miss. Coll., 247, p. xiv.

in the preceding instance, it bore the relation of a ray to the ossicles representing the pelvic bones.

In addition to radiate nutrition, as shown in small and subordinated areas in an animal in which another type of nutrition is dominant, we may have, as in vertebrates, the principle of bilaterality announcing itself in small territories of tissue apparently uninfluenced by the larger expression of force operating in the same direction elsewhere. Indeed, we may say that bilaterality is not merely a principle of right and left adaptation; but may be found operating anywhere, and, perhaps, in more than one place at a time. Thus, the development of the sternum is independent of the development of the vertebral column. It arises between the ends of opposed costæ, and when this occurs in a single symmetrical individual, it would appear to be influenced by some deep-lying typal condition. But in double monsters the sterna, when present, do not belong to either individual, but arise between the right ribs of one individual and the left ribs of its opposite. Such a sternum thus takes its place on either side of the dual organism. It is very evident that these sterna cannot be identified with either individual, but are rods, symmetrically segmented, orignating *de novo* in an intra-costal space, and entirely irrespective of the bodies from which these costæ spring.

FURTHER NOTES ON "INCLUSIONS" IN GEMS, ETC.

BY ISAAC LEA, LL.D.

In a communication on microscopic crystals contained in *gems*, which the Academy did me the favor to publish in its Proceedings[1] a few years since, I gave some figures of these crystals which I have frequently since verified. I then observed that, beside these *inter-crystalline forms*, there were in most *gems*, *cavities* frequently so numerous that they amounted to tens of thousands.

Since the period of the publication of my paper, I have made very large additions to my cabinet of *gems*, and particularly those of the *Corundum* group, *Sapphires*, *Rubies*, and the so-called *Oriental Topaz*, *Oriental Amethyst*, *Asteria*, etc. In the numerous fine blue *Sapphires* of my collection, I have rarely explored one without finding numerous cavities, and ordinarily also finding the beautiful microscopic acicular crystals, which, when the specimen is cut *cabochon*, cause the three bands, and these by crossing form the star in *Asteria*. The cuneate microscopic crystals are also quite common.

Cavities, with or without the fluids, are so frequent in *crystals*, from the soft *Calcite* to the hard *Corundum*, that little may be said as to their occurrence, as they are so common.

Cavities in quartz crystals inclosing fluids have been observed by the older mineralogists, but the kind of fluid, and gas or air, was not ascertained by them. Sir Humphry Davy, in 1822,[2] investigated the contents of these cavities, and found them generally pure water. The gas bubbles were sometimes found to be "*azote*." Sir David Brewster, in 1823,[3] published a memoir of great research and value. He first had his attention called to the examination of fluid in cavities by the explosion of a crystal of *Topaz* when heating it. He found cavities and air bubbles in nearly twenty different substances, and these inclusions were carefully examined by him. In some of these cavities he observed two fluids[4] and crystals, and these are figured in his plates. Subse-

[1] Feb. and May, 1869.

[2] Phil. Trans., 1822.

[3] Trans. Roy. Soc. Ed., 1823.

[4] These two fluids, Prof. Dana without any analysis has called *Brewster-*

quently, Mr. Sorby published a long and admirable paper[1] on *Fluid cavities and crystals* in minerals, with numerous and interesting figures. He considered that the cubic crystals were probably *Chloride of Sodium*. In his investigation he proved, by forming artificial crystals, that, in a natural state, the fluid cavities, with their "inclusions," must have been formed by aqueo-igneous forces. He gives a figure of fluid in mica, but I have never seen any in that mineral, although many hundreds have passed under my microscope in looking after crystals of *Magnetite*, etc. Mr. Sorby also published a paper on cavities in quartz in the Phil. Mag., vol. xv. p. 153; also with Mr. Butler in Proc. Roy. Soc. London, vol. xvii. p. 299. Kirkel on Microscopic Minerals, Neues Jahrbuch, 1870, p. 80, mentions bubbles and cubic crystals in quartz. He found iron glance and fluid in *Elæolite* = *Nephelite*. In *Emery*, from Naxos, he found fluid in cavities.

In 1872, Proc. Roy. Soc. Edin., p. 126, Mr. Sang published an account of water in cavities of *Calcite*.

Very recently, Prof. Hartley, King's College, London, has published a very able paper on the subject of the fluid in quartz, etc.[2] He says that Simmler in 1858, offering an interpretation of Brewster's observations, concluded that the expansible liquid was carbon dioxide. Professor Hartley states that in many cases the liquid in quartz is water, but that in some cases he found the two fluids, and his very satisfactory and careful experiments show conclusively that the most volatile of the two fluids is carbonic dioxide. He found in every experiment, that the fluid disappeared when exposed to 31° C., and reappeared on cooling. Prof. Hartley accords with Mr. Sorby in his reasoning that "at the time of its assuming the solid state, the solution endured a high temperature."

Calcite has been found to contain nearly a quart of this fluid,[3] but it is not as common to be found in small cavities as it is in quartz.

Fluorite.—Cavities in this mineral are rarely found, but they are sometimes seen with fluid and air bubbles.

Apatite.—I have never observed cavities in this mineral, but I have not given it much attention in microscopic examinations.

[1] Journ. Geol. Soc., vol. xiv., 1858, Micro-structure of crystals.

[2] Journ. of the Chem. Soc., London, Feb. 1876.

[3] Specimen in the collection of the late Dr. Chilton of New York.

Feldspar Group.—In a former paper,[1] I gave the result of the examination of many specimens of various species. Since then I have examined numerous specimens of *Labradorite*, and found no cavities, but the black crystals were very numerous. In the *Moonstone* of this country, I have not observed cavities or crystals, but in two specimens, out of about one hundred from Ceylon, I have seen a series of very regular quadrate cavities or crystals which do not appear to have any fluid. Fig. 10, Pl. 2.

Tourmaline.—This interesting mineral is found beautifully crystallized and of almost all colors, white, brown, green, red, black, etc. The finest are found at Mount Mica, near Paris, Maine.[2] Some of these specimens have small internal elongate crystals, which are terminated. A red specimen (*Rubellite*) in my collection has many irregular cavities. One green one from Ceylon has cavities with fluid, and another has very minute black acicular crystals in one direction. In brown crystals from Lower Dianburg, Carinthia, there are rough objects in the interior, evidently another mineral inclosed, which do not require the microscope to detect them.

Cyanite.—Of the white and the blue varieties I have not observed any well-defined cavities or crystals, but in the gray-bladed *Cyanite*, found at Cope's Mills, near West Chester, Pennsylvania, there are always, I believe, small black masses which do not take a regular form, but are usually elongate. These may easily be detected by splitting a crystal along its eminent cleavage, and examining the cleavage face with a lens of small power, but a higher power is preferable.

Quartz takes upon itself many colors. In it are found cavities in very great numbers, particularly in the clear fine crystals. Those which exist in such an abundance in Herkimer County, New York, and which are so limpid, and finely and doubly terminated, are sometimes furnished with thousands of cavities, even in small specimens, and these are of many various forms, frequently containing fluid. In some cases the fluid may be seen to move by the unaided eye. In these Herkimer crystals, carbon in the form of *Anthracite* is of very common occurrence,

[1] Proc. Acad. Nat. Sci., May 11, 1869.

[2] Dr. Hamlin has published a beautiful little work on the Tourmaline, with illustrations.

and in one of my specimens a small portion moves in the fluid of a cavity. These cavities often exist in an entire sheet, almost across the prism of a crystal.[1] In *smoky quartz*,[2] these cavities are much rarer, as also in *Amethyst and wine-color and green quartz*. The *Amethyst* is frequently penetrated with crystals of *Rutile*, and these are often very large, sometimes 1 to 4 inches long. The Chester County specimens usually have numerous curved filamentous crystals, easily detected with a common lens. In Way's Feldspar Quarry, near Dixon's, Delaware, there is a very peculiar form of *quartz* which is nearly transparent, but somewhat clouded. The fragments of all sizes, from that of a pin's head to that of a small walnut, are inclosed in a mass of *Deweylite*. These fractured pieces are of indefinite forms. They are evidently cryptocrystalline, and look as if they may have been heated and suddenly cooled, and thus fractured. When these pieces are subjected to a high power, there may be detected in them very minute *oval cavities* in great numbers, and the major axes usually placed in one direction. I have never seen cavities in *milky quartz* or *blue quartz*. Sir David Brewster found many cavities in rock crystal from Quebec with "water and mineral oil."[3]

Topaz.—In the various beautiful crystals which this mineral presents, there are frequently found cavities with fluid, and sometimes in this fluid may be seen the cuboid crystals described by Sir David Brewster. He found a single fluid in some cavities, and in others two fluids with "air bubbles." He says the fluid does not expand with heat. The Saxony transparent white crystals sometimes have cavities, as well as those of pale wine-color. The Brazilian gold-yellow specimens have these cavities very frequently. The clear pinkish are more free from them. I have never observed any microscopic acicular crystals in *Topaz*.

Emerald, Aquamarine, and Beryl—constitutionally the same—differ very much in regard to their possession of cavities and their commercial value. So far as I have been able to examine fine specimens of *Emerald*, it is rare to see one without cavities. One which I have, of very fine color, has many cavities of various forms,

[1] Sorby, Journ. Geol. Soc., 1858, found many cavities, and thinks that the cubic crystals inclosed are probably chloride of sodium, as mentioned above.

[2] The smoky quartz of Pike's Peak has hexagonal spangles, which may be mica.

[3] Trans. Roy. Soc. Ed., vol. x.

in which are included a fluid enveloping generally two perfect cubic crystals of an unknown mineral. In all cases in this specimen, the second crystal is much the smaller. Fig. 11, Pl. 2.

In Aquamarine, cavities are not frequent, and in *Beryl* I have detected them only in a specimen from Unionville, Penn. Fig. 12, 12*a*, Pl. 2. In this there is a biangular cavity with a small cubic crystal at an inner angle. Throughout the mass there are small suboval cavities.

Garnet.—As a precious stone this is by no means rare, but it is lustrous and of a fine color. Cavities and microscopic crystals are very common in this gem.[1] The cavities are usually irregular and rough, and never to my knowledge have fluid. On a polished surface of a piece of garnet from North Carolina, nearly an inch long, the reflection of these crystals covered the whole surface with prismatic colors.

Cinnamon Stone.—This beautiful variety of *garnet*, from Ceylon, as far as I have been able to observe it, and I have some twenty cut specimens, and numerous rolled pieces, has irregular cavities and some crystals, as I have stated in a former paper.

Zircon.—With its high refractory power, this is used frequently as a *gem*, and sometimes sold as a diamond when white and perfectly transparent. One of the numerous specimens which I have examined has cavities[2] and microscopic crystals, and a specimen from Ceylon has remarkable dark brown, elongate, fusiform spots, with numerous dotted ones intervening. Fig. 9, Pl. 2.

Chrysoberyl.—The few specimens I have of this beautiful *gem* have neither cavities nor microscopic crystals, but Brewster observed "strata of cavities and both the fluids."

Chrysolite = Olivine.—In some of my specimens I have observed small cavities with fluid. Brewster met with them containing "fluid and bubbles of air."

Spinel.—This *gem* occurs of several colors. The *Spinel-ruby*, so called, sometimes is very close in color to the true *Ruby*, but it has not by any means the depth nor brilliancy of the true *Ruby*. In a pale-green specimen of great beauty which I have received recently from Ceylon, I have not been able to detect cavities or

[1] Proc. Acad. Nat. Sci., Feb. and May, 1869.

[2] In a specimen in Dr. Leidy's fine cabinet, there are anastomosing cavities.

crystals. In my former papers I have expressed uncertainty in this matter.[1]

Iolite.—This *gem* is inferior in hardness, color, and specific gravity to *Sapphire*, but is valued for its peculiar change of color, being dichroic. One of my specimens is without any inclusions. The other is filled with blue four-sided prismatic crystals, which are long, and inclosed in a nearly white subtransparent mass. These crystals are sometimes broken and their parts prolonged in the mass, and they are all lying in nearly the same direction.

Turquoise, with its peculiar and agreeable blue, is never transparent, and neither cavities nor microscopic crystals are found in it.

Opal.—This exquisite gem, which displays such brilliant colors, is very highly valued. It is but little harder than glass, and is indeed considered as volcanic glass. Its remarkable flashes of color are attributed to fissures, in accordance with the theory of Newton's colored rings. I have never been able to detect either cavities or minute crystals in this beautiful gem—except in two cases. One of my specimens has a brown, terminated crystal, a six-sided prism of an unknown substance, about one-fifth of an inch long, and terminated by a single oblique plane; the other has several smaller ones.

Lapis-lazuli.—This was used by the ancients as a favorite *gem*, but it is not now valued as such. I have not been able to detect cavities or minute crystals in any specimen in my possession.

Corundum.—This very interesting mineral, when in perfect transparent crystals, is highly valued as a *gem*, under the name of *Sapphire*, *Ruby*, etc., according to color. When yellow, it is called *Oriental Topaz;* when purple, *Oriental Amethyst.* When purely white it is sometimes sold as a *Diamond.* In this country we have two localities only of *Corundum* where any large quantity has been found, that of Chester County, Pennsylvania, and Franklin County, North Carolina. From the mines in Chester County, several hundred tons have been taken, but no transparent crystals. Some opaque ones are bluish and some pinkish. The North Carolina locality has produced some very large crystals, and numerous small ones. Of the latter there have been found many quite pure and transparent, and these are sometimes blue and sometimes red. But none of them yet found are of value as

[1] Proc. Acad. Nat. Sci., Feb. and May, 1869.

gems. The fine *Sapphires* and *Rubies* are chiefly from Ceylon, and they form some of the most beautiful objects in nature. I have many of these in the form of worn pebbles, and some in fine hexagonal form, as well as hundreds of cut specimens. I have examined carefully more than one thousand specimens, with a view to discover whatever "inclusions" they might possess. In a communication to the Academy,[1] I described and figured some microscopic crystals in these and other *gems.* Since then I have added a very large number to my collection, and among these several hundred large and small transparent crystals. In a careful microscopic examination of these, I found a large number which contain cavities and minute crystals, the former sometimes scattered irregularly through the mass, and sometimes forming a sheet or film. These cavities are of all forms, but usually sub-elliptical; sometimes tubular, and these tubes frequently anastomose in a very beautiful manner. These cavities are so numerous that they frequently give a cloudiness to the specimen, which is less valuable as a *gem*, but most interesting in a scientific point of view. In some specimens these cavities exist by tens of thousands, and Sir David Brewster stated that in a specimen under his observation there were about 37,000 of these cavities. I am sure that in one of my large cut specimens there must be more than double that number. It is a very common thing to see hundreds at a time of these cavities in the Ceylon specimens, partly filled with the fluids previously alluded to in these notes. But it is quite rare that they are found in the specimens from North Carolina. Still I have seen them in the transparent small fragments of deep blue crystals, and sometimes in the transparent light-colored ones. In one specimen of the latter, I discovered some most interesting cavities, which contained, beside the *fluid*, each a *single cubic crystal*, Figs. 1, 2, and 3, Pl. 2. I had never observed an included crystal in any cavity in the numerous Ceylon specimens which I have examined. These cubic crystals have the exact form and appearance of those in the *Emerald* described herein.

In regard to the microscopic crystals in *Sapphire*, having described and figured them in the papers before alluded to, I have little to add now. Further observation has confirmed what I then

[1] Proc. Acad. Nat. Sci., 1869.

stated regarding the radii of *Asteria*. Very recently I have received a number of these *Asteria* of various colors, blue, purple, white, red, and dove-color; several three-quarters of an inch in diameter. The red and purple specimens are of peculiar beauty, and when examined in the sun, or any strong light, they both exhibit the microscopic acicular crystals with peculiar beauty, displayed as they are in hexagonal form, and reflecting the spectral colors. The *Ruby Asteria* is certainly among the most beautiful objects in nature, and the purple are very little less so.

In some crystals of *Corundum*, there is a strong bronze reflection, and this is the case with some of the large hexagonal crystals which were imported by Mr. S. S. White from India for commercial purposes, and which he distributed with so much liberality to our mineralogists. These bronze crystals have also been found at the Black Horse and Village Green localities in Delaware County, Pennsylvania. When examined with a good power, these bronze reflections are at once seen to be caused by minute acicular crystals, and these may sometimes be seen in bunches.

A *pale Ruby*, "Rubicelle," which I lately received from my friend Hugh Nevill, Esq., Ceylon, about three carats, is a most interesting and beautiful *gem*. It has the depth and brilliancy almost of the diamond. It is nearly of a rose-color, and is perfectly transparent. It is cut with a top table and not entirely symmetrical. Its refractive power is unusually great. Yet when this brilliant transparent *gem* is examined with a high power and strong light, the whole mass may be seen to be filled with long acicular crystals in three directions, parallel to the prismatic planes, and interspersed are numbers of very minute and delicate cuneiform crystals.[1] It has also a small cloud of exceedingly small cavities.

Another remarkable specimen may be mentioned here, which has small cavities and minute microscopic crystals. It is of a pale yellow or straw-color, and of a depth and brilliancy scarcely exceeded by the diamond.

During the examination, about two years since, of some hundreds of small crystals of *Sapphire*, perfectly transparent to dark blue, I discovered one which had very singular plumose impressions on the planes of the prism. This induced me to examine carefully all those which I subsequently procured, and I have now over a

[1] Proc. Acad. Nat. Sci., May 11, 1869.

dozen specimens which exhibit this very singular character.[1] I am entirely at a loss to discover the cause of this form of minute impressions on so hard a substance. It evidently has been formed by some collateral mineral substance, against which the molecules in crystallization have been arranged.

Diamond.—The hardest of all substances stands first among *gems*. It has not, however, much interest to the microscopist, as no cavities with fluid have been, so far as known, observed, nor has it included crystals of foreign substances. They are often very imperfect, containing rifts and discolorations. Some of my specimens have beautiful triangular impressions on the surface of the planes. My friend, Dr. Hamlin, of Bangor, Maine, is engaged on an extended work on the diamond. Such a work is much needed, and I know no one as capable as he to accomplish it. This gem sometimes occurs of various colors. In my cabinet I have six different colors.

REFERENCES TO PLATE 2.

Fig. 1, 2, 3, Plate 2. Represent cavities and crystals in a specimen of transparent *Corundum* from Franklin, North Carolina. In no other specimen of the numerous ones I have examined have I found cavities with a fluid and included crystals both, while it is very common in the Ceylon *Sapphires* to have cavities without an included crystal.

Fig. 4. A *Sapphire* from Ceylon, given to me by Dr. Ruschenberger, has cavities without fluid; the cavities being in the form of crystals in the larger ones, but in the numerous small ones subrotund. These cavities are interspersed throughout the mass with numerous acicular crystals running generally in two directions.

Fig. 5. A specimen of blue *Sapphire* (Ceylon), with four nearly perfect subhexagonal crystals, somewhat flattened. These are surrounded by an immense number of minute cavities, some of which anastomose. The crystals seem to be filled with a black fluid. There are also very minute acicular crystals.

Fig. 6. In the same specimen with the above, there is a group of very different crystals which are here represented. These can only be seen with a proper angle of light. Then they reflect all the colors of the spectrum. This group consists of very perfect cuneate and acicular crystals, and is somewhat like that figured in my pl. 9, fig. 2, Proc. Acad. Nat. Sci., May, 1869, but the crystals are much more defined and perfect than in that plate.

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[1] Figs. 7 and 8, Pl. 2.

Fig. 7. Represents a small blue *Sapphire* one-fourth of an inch long. The very remarkable plumose impressions cover all the six prismatic planes.

Fig. 8. A blue *Sapphire* similar to Fig. 7, about three-sixteenths of an inch. The prismatic planes here are covered with impressions more in a dotted form. These two (Fig. 7 and 8) were examined with a power of one hundred diameters.

Fig. 9. A specimen of *Zircon* from Ceylon has very singular, dark brown, elongated fusiform maculations, in one direction. These are surrounded with numerous dotted ones.

Fig. 10. Among all the numerous specimens of *Moonstone* which I have examined I have found two only with "inclusions." These have numerous parallelograms which look like cavities, but may be true crystals of some foreign substance. There is no appearance of fluid in them.

Fig. 11, *a*, *b*, *c*, *Emerald*. A very fine specimen in my collection is filled with exceedingly interesting cavities with included cubic crystals, enveloped by fluid. The forms of the cavities are exceedingly varied, and the cubic crystals—generally *two*, a small and larger one—are remarkably perfect. These characters make this specimen one of very great interest.

Fig. 12 and 12*a*, *Beryl* from Unionville, Pennsylvania. Fig. 12 represents a remarkable biangular cavity with a cuboid crystal at one of the interior angles—has no fluid. Fig. 12*a* represents in the same specimen two cavities with fluid and air bubble. Both figures represent the numerous irregular cavities and imperfections which exist throughout the mass.

Note.—I have made these drawings with great regard to correctness, and the artist has well represented them.

JUNE 6.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-five members present.

Fertilization of Flowers by Insect Agency.—Mr. THOMAS MEEHAN remarked that the subject of cross fertilization and fertilizing by insect agency, was still one of absorbing interest.

There was no question about the facts; differences of opinion arose as to the meaning of the facts, and the extent to which they prevailed.

Contrary to the belief of many distinguished botanists, he could not see that those plants which were arranged for cross fertilization had any advantage in the "struggle for life" which prevailed in races, over those which were closely fertilized by their own pollen; and again, he found that many plants which were adduced by his friends to prove arrangements for cross fertilization, in fact fertilized themselves.

He said he would to-night refer only to three remarkable cases, the Scrophularia, dandelion and ox-eye daisy, and the red clover, and he selected these, because the distinguished author of "How Plants Behave," Professor Asa Gray, had made much use of the two first named in his book in describing arrangements for cross fertilization; and, as Professor Gray was present this evening, he felt sure that with his usual friendliness and good feeling towards all who were earnestly seeking the truth, he would do the meeting the favor to correct him if he found the speaker's observations not confirmed by his own. Red clover he would refer to, because it was oftener quoted. Red clover was, in fact, the *Vade mecum* of the insect fertilizationist.

Mr. Meehan then exhibited specimens of *Scrophularia canina*, and explained its floral development. The pistil protruded while yet the anthers were rolled back in the throat of the corolla. One by one these stamens were straightened out, the anther coming into close proximity with the stigma, when it burst, and by the contraction of the sacs, the pollen was ejected, falling on the stigma. The pollen was of a brilliant orange color, and the stigma of a pearly white, so that the smallest particle could be seen even by a good naked eye; and could be easily noted if carried to the stigma of other flowers by insects. Small sand wasps and other winged insects visited the flowers in extraordinary abundance; but it could be seen by observers that no pollen appeared on any stigma until the bursting of its own pollen sacs. Professor Gray, he said, in "How Plants Behave," had described "Scrophularia" as acting in a very different way to this, making no exception to any species, though it was fair to note that the illustra-

tion accompanying the text was of *Scrophularia nodosa*, a species not yet in flower with him.

Composite plants, he said, had been referred to as illustrating the peculiar arrangements for insect fertilization. The colored ray petals had been characterized by his friend as so many flags alluring winged insects to where the sweet secretions were, in order that they might bring foreign pollen at the same time. In his vicinity, surrounded as he was by an abundance of sweet flowers, he had never seen a winged insect on dandelion or ox-eye daisy (*Chrysanthemum leucanthemum*), though, on the waste grounds near him, they were in bloom by the thousand; but every little flower perfected a seed There were millions on millions of seeds, and even admitting that there might be some winged insects at them that he did not see, they were certainly so scarce that it was out of the question to suppose that each of these had been fertilized by winged insects. He had found thrips in some flowers and on one occasion an ant, but these were too few for the immense work to be done. But this presumptive argument was unnecessary, as a careful observation of how the plants behaved, showed they were self-fertilizers. In the dandelion, he said the united column of stamens perfected, and spread its pollen in advance of the pistil. As the pistil grew it carried the pollen with it. The apex of the pistil then forked, and as the interior surface of the cleft alone had the stigmatic surface, it had been argued that none of the pollen could be used for itself. But a watcher would see that as the cleft opened the pollen on the *line of the cleft* fell in. It was but a little, but that was enough. Then the position of the upper part of the pistil in the dandelion favored this intrusion of the pollen. Just before the expansion of the stigmatic lobes, the pistil curved at the apex, and the slit opened first on the upper side of this then horizontal position. The pollen easily fell into the chasm. The lobes finally separated, until they became directly opposite to each other as generally seen in the dandelion. While this is going on, the lobes, having pollen abundantly on the under side, as they are sweeping the horizon, drop pollen, or even rub their surfaces on the expanded stigmas of the flowers below, and in this way, if they had no pollen of their own, the lower flower would be fertilized by that above. This would be cross-fertilization, but not by insect agency. But what if it were? Physiologically speaking, what benefit can it be to a composite flower to be fertilized by another from its own head, even granting the utmost asked by those who consider composites arranged for cross-fertilization? The composite flower is not a compound flower, it is true. It is but an imperfect umbel. But each umbel for all physiological purposes might as well be a single flower. Side by side the flowers are set, as any one familiar with the dotted thimble-like receptacle of dandelion very well knew. They all had just the same food, the same light, the same conditions of

life in every material effect. If the familiar illustration by reference to the human family has any weight in plants, surely these flowers must be brother and sister, in any sense claimed by insect fertilizationists; and the physiological benefits to the race would be no more than if the whole head was a single flower, as a Ranunculus, instead of the compound flower we see. He then explained the manner of fertilization in the ox-eye daisy. The united column of stamens was forced from its holdings by the growing pistil, which finally attempted the cleavage of the apex, while still holding the cap-like covering of anthers over it. The pollen fell into the stigmatic cavity more easily than in the dandelion. Insects might visit it subsequently; it would make no difference, having already received its own pollen.

In regard to clover, Mr. Meehan said that in his remarks at Detroit last year, he had stated that he had watched a field of clover, found remarkably few insects at work, and yet the crop of seed was abundant, and that a careful examination of the clover blossom in all its stages convinced him that from its structure and behavior it was a self-fertilizer. He had been met with the assertion that the first crop of clover never produces any seeds. This was so generally believed that it must be true to a great extent. He could not have been mistaken last year, but he visited a field of two acres again a few days ago, and now exhibited heads nearly mature, all the flowers with seeds, and these (June 6th) about the first flowers that could have formed. On this visit he watched the field for an hour, and in that time saw only eight humblebees at work, rather small grist, he thought, for so large a mill, if all those flowers had to be insect fertilized. He watched their motions closely, and found, to his astonishment, that in spite of the elaborate arrangements for the work of the humblebees in the mouth of the corolla, they did not enter that way at all! They made a *slit in the base of the tube*, extracting the honey in this surreptitious way. With this final fact, if found general, there must be an end of the clover case. There was no bottom for the "arrangements" to stand on.

He had intended, he said, to rest the case here, but he had mentioned to his friend, Professor Gray, that he had noted the common bladder-nut, *Staphylea trifolia*, as being a self-fertilizer. It was one of those observations so recently made by him that he should not have introduced it to this body without further investigation; but Dr. Gray had suggested to him to refer to it, as he thought he could show it could not be fertilized except by insects, so he detailed what he had seen simply in order to have the benefit of Dr. Gray's experience.

Dr. ASA GRAY said that Mr. Meehan and himself, looking at the same subjects with somewhat opposing prepossessions, were apt to see different facts; that is, either was likely to notice some particular which was not noticed by the other. For instance, Mr.

Meehan had some little time ago called his attention to the bladder-nut (*Staphylea*) as a case of close fertilization; but Dr. Gray's own observations, made in consequence of this suggestion, convinced him that this was a good case of arrangement for cross-fertilization. Like many other flowers, it was capable of self-fertilizing; for the anthers, charged with pollen, were contiguous to the edges of the dilated stigmas. But what his acute friend had omitted to notice was—that the flowers were hanging, and that, although the anthers surround the stigmas, the pollen is not ejected, but lies on the opened face of the anther in a thick coating, and when it falls, it will drop to the ground instead of upon the receiving stigmatic surface; some, however, may come in contact with its margin. Moreover, Dr. Gray found that the stigma was earlier than the anthers by twenty-four or forty-eight hours. The stigmas, borne on styles then considerably longer than the stamens, occupied the very entrance of the corolla as soon as it began to open, and was, as he found, in condition to be pollenated a day or two before the anthers of that blossom opened. Now in each raceme there were flowers in all stages, and the blossoms, as Mr. Meehan declared, were the favorite resort of bees; these while feeding from a flower with anthers open must needs smear their faces with the pollen, and when visiting flowers a day or two younger deposit some of this pollen upon their stigma, at a time when it could not possibly get any from its own anthers.

As to *Scrophularia*, his observations upon *S. nodosa* had prepared him to make a different reading of the facts now shown in *S. canina*. The arrangements for cross-fertilization in *S. nodosa*, as detailed and figured in the little treatise which Mr. Meehan referred to, seemed essentially similar in *S. canina*, except that both stamens and style were much exserted. Mr. Meehan had described the early protrusion of the style and the straightening and lengthening of the filaments a day or two later, so as then to bring the anthers into proximity with the stigma. But Dr. Gray doubted if any of that pollen ever acted upon the contiguous stigma, even if it reached it, thinking it more probable that the stigma was by this time withered and past fertilizing, as was the case in its relative, *S. nodosa*. The arrangement was a capital one for cross-fertilization, bees passing from flower to flower, brushing the same part of their body against the anthers of an older and the stigma of a younger flower; while self-fertilization was impracticable, at least, in *S. nodosa*, because no one flower shed its pollen until its stigma was past receiving it.

As to clover, Dr. Gray could now say nothing, except that it was a member of a tribe of plants which, though seemingly arranged for self-fertilization, were actually for the most part capital examples of the contrary.

His attention had been called by Mr. Meehan to Dandelions, which, from general recollection, he thought were frequented by flying insects. The first walk he took in his own neighborhood

did not confirm this impression; but on the second he found small wasps and a dipterous insect busy with the dandelions, and flying from one to another, and also ants in abundance. It was clear that the narrowness of the style-branches in this and other liguliflorous compositæ gave them a chance for self-fertilization, but their characters were equally good for crossing through insect agency. As to ox-eye daisy, he could not confirm Mr. Meehan's description as to the carrying up of the anthers upon the style, which must have been abnormal. Dr. Gray supposed that the arrangement would be found to be like that of the allied Feverfew, which was well figured by Lubbock, after Ogle, and this clearly betokened cross-fertilization. About Cambridge, ox-eye daisies were so infested with small insects that ladies objected to having them brought into the house among cut flowers; and flying insects, he thought, did not disdain them.

As to the benefit of cross-fertilization, this was a large subject, which could not be disposed of in a few words; but Dr. Gray thought it probable that cross-breeding even of flowers in the same inflorescence was better than self-fertilization, and that wherever this occurred wider crossing was common.

Mr. MARTINDALE called attention to the fact that, in the case of Staphylea, the stigma is ready for the pollen some time before it can receive it, and suggested that, therefore, perhaps the first flowers do not produce seed.

Dr. GRAY rejoined that it could seldom happen that the first flower of every branch on a shrub or tree, or on different trees of the neighborhood, all opened on the same day; so that even the earliest flower had a fair chance to be fertilized.

Mr. MEEHAN handed a specimen of *Orobus atro-purpureus* from the table, and remarked that it might aid in settling that question; as, so far as his recollection now served him, it was the first flower of the season and of the raceme, and only the first flowers that generally perfected seed.

On Samarskite.—JOSEPH WILLCOX made some additional statements in reference to samarskite, which, until recently, has been a very rare mineral. The first discovery of it in Mitchel County, North Carolina, occurred in the spring of 1873, in a mica mine; and during that and the succeeding year about 700 pounds of the mineral were found, since which time the mine has not been operated.

JUNE 13.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "On the Occurrence of Helix terrestris, Chemn., in North America," by Wm. G. Mazyck, was presented for publication.

On a New Genus of Fossil Fishes.—Prof. COPE described a species of fish represented by a fragment of a jaw, which was said to have been derived from the phosphatic deposit near Charleston, S. C. The fragment indicated a species of large size, and supports alveoli or teeth to the number of ten in a space of M. .080. The crowns of the teeth are compressed, with a broadly rounded apex; the section at the base being lenticular, with sides swollen and apices produced. The latter are the sections of a cutting edge, which constitute the apex as well as the borders of the tooth. The longitudinal transverse section is triangular. The root is not composed of dentine, but of an ossified pulp, of osseous tissue, as in the *Pythonomorph* reptiles. This portion is nearly concealed in the alveolus, and there are no foramina along the inner side of the jaw communicating with the pulp cavities.

The succession of the teeth has been from below, as in the *Saurodontidæ*, the crown of the young tooth being developed below the centre of the root. Absorption followed; so that the centre of the root disappeared, leaving a cylinder with thin walls of osseous tissue running at right angles to the fibres of the inclosing jaw. The root has a lateral groove, which at this stage constitutes a fissure opening into the central cavity of the adjoining root. The osseous tissue at the base of the crown is quite spongy. Length of bases of five teeth M. .040, or long diameter of crown at base M. .008. Transverse diameter of base of crown .007; elevation of crown .010.

This fish belongs to a genus hitherto unnamed, presenting resemblance and perhaps affinity to *Pachyrhizodus* and *Conosaurus*. It differs from both in the compressed trenchant crowns, and from the first named in the entire inclusion of the roots in alveoli. From *Saurodontidæ* it differs in the absence of true dentinal roots. It was named *Cyclotomodon*, and the species, *C. vagrans*.

JUNE 20.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-two members present.

The Botanical Section reported that a meeting for organization had been held, and that officers had been elected, as follows:—

Director,	W. S. W. Ruschenberger, M.D.
Vice-Director,	Thos. Meehan.
Conservator,	Chas. F. Parker.
Recorder,	Isaac Burk.
Treasurer,	Jose O. Schimmel.
Secretary,	Henry Leffmann, M.D.

Remarks on Vertebrate Fossils from the Phosphate Beds of South Carolina.—Prof. LEIDY observed that in a further search among the objects of the Agricultural Department of the Government Building of the International Exhibition, he had found another fossil specimen of a ziphioid cetacean. Like those previously described, it consisted of a detached beak, from the property of the Wando Mining Co., on the Ashley River, S. C., and was obligingly loaned by Mr. Amidon.

The specimen, exhibited to the Academy, has nearly the form and other characters of the one last described under the name of *Proroziphius macrops*. The bones are thoroughly co-ossified, and the condition of the beak indicates a mature animal, smaller than the species just named. The beak is 19 inches long in advance of the nasal apertures, and is about 3¾ wide near the middle. The supra-vomerian canal is closed over to within less than four inches of the end of the beak by the complete coallescence of the intermaxillaries. The prenareal fossæ are funnel-like, and terminate forward in a canal penetrating the maxillaries instead of first being prolonged into an open groove as in *P. macrops*. The anterior extremity is drilled in a remarkable degree by boring mollusks. With the other specimens previously indicated, the present one will be more fully described in a memoir on the vertebrate fossils of the Ashley phosphate beds. The species was named *Proroziphius chonops*.

Prof. Leidy further remarked that while examining the materials from the different phosphate beds of South Carolina, and mainly those exposed to view at the International Exhibition, his attention had been attracted by the large size of many of the teeth referred to *Carcharodon megalodon*. Among many teeth of this species, and others of *C. angustidens*, etc., contained in a show-

case of the Bradley Fertilizer Co., in the Agricultural Hall, there is a megalodon tooth, from the Stono River, which measures 6 inches 8 lines in median length from a level of the ends of the root to the point of the crown, and 4 inches 8 lines in breadth across the base. A second specimen in the same collection and from the same locality is 6 inches in median length, and 5 inches 1 line in breadth.

A specimen from the Ashley River, formerly in the possession of Prof. Holmes, according to him, measures 6 inches 5 lines in length, and 5 inches 5 lines in breadth, and weighs 2 lbs. 8 drachms, apothecaries' weight.

These specimens are probably the largest shark teeth on record. If the animals to which they pertained held anything like the relation of length of body to the teeth as existing in the living white shark, they must have been upwards of a hundred feet in length.

JUNE 27.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-one members present.

Remarks on the Rhizopod Genus Nebela.—Prof. LEIDY stated that in order to facilitate a ready reference to ordinary forms of rhizopods, he was disposed with some other observers to restrict the genus Difflugia to those rhizopods with lobose pseudopods, which ordinarily possess a covering or test composed of extraneous bodies, such as particles of quartzose sand, and diatome cases. In the genus Nebela, which he had viewed as distinct from Difflugia, the test is composed of discoid plates and minute rods, apparently siliceous and intrinsic to the structure of the animal.

To the genus Nebela probably belong the species named by Ehrenberg, *Difflugia collaris*, *D. cancellata*, *D. carpio*, *D. binodis*, *D. annulata*, and *D. laxa*. Likewise the *Difflugia peltigeracca* of Carter, most of the forms described by Wallich under the name of *Difflugia pyriformis*, var. *symmetrica*, and also the *Difflugia carinata* of Archer. Formerly Prof. L. had indicated several species under the names of *Nebela ansata*, *N. equi-calceus*, *N. sphagni*, *N. numata*, *N. barbata*, and *N. flabellulum*. Pr. A. N. S. 1874, 156.

Most of the above-named species of Ehrenberg had been referred by the same author to a group with the names of Reticella and Allodictya, headed with a species named *Difflugia asteropliora*, which, so far as could be judged from the description and figure, did not coincide with the characters of Nebela. Of the forms referred to *Difflugia symmetrica* by Dr. Wallich, the first one described has recently, by Schulze, been viewed separately from the others as characteristic of a new genus with the name of

Quadrula symmetrica. The test of this is composed of quadrate plates, arranged in rows, like bricks in a wall.

In all the species referred to Nebela, which have been observed by Prof. L., in all instances the test is compressed pyriform. Wallich remarks in reference to the tests of *Difflugia symmetrica*, that they "are sometimes so compressed as to give the aperture the undulating appearance represented in Figs. 27, 29 and 30, but more frequently the tests are not compressed, and the aperture presents the ordinary circular or nearly circular outline."

The species *Nebela numata*, probably synonymous with *D. collaris*, is an exceedingly abundant form, in much variety in our sphagnum swamps, and illustrates well the character of the genus, and also exemplifies the extraordinary variation in the structure of the test, which appears to be common also in the other species of Nebela.

In some individuals of *Nebela numata*, the test is composed of or invested with comparatively large circular disks of uniform size, as represented in the diagram (Fig. 1). In other individuals the disks are of the same character, but oval as in Fig. 2. In other

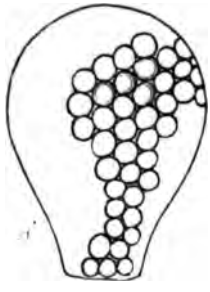


Fig. 1.

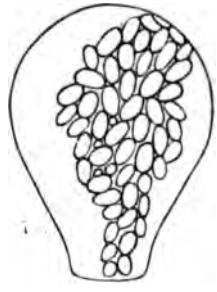


Fig. 2.

individuals again the test is invested with circular or oval disks as in the former, but separated, uniformly scattered, and with the intervals filled with small circular disks as in Fig. 3. In other instances large circular or oval disks occupy the fundus of the test, and small ones extend from one-half of the body to the mouth, sometimes mingled with a few of the larger disks. In some instances the test is composed of minute circular disks alone, or with a few large oval or larger circular ones scattered here and there.

Generally the disks of the tests are sharply defined, closely placed, and touching at their contiguous edges. Sometimes they are crowded, and assume in a certain focus a more or less polygonal outline. Sometimes they appear to overlap the edges Usually very distinct; they are sometimes more or less indistinct

The large disks in a certain focus appear centrally shaded, and exhibit a striking resemblance to ordinary blood corpuscles.

Not unfrequently the test is mainly or almost entirely composed of minute rods, placed in alternating oblique patches, with a few minute round disks, as in Fig. 4. In other tests the disks pre-

Fig. 3.

Fig. 4.

dominate. In some tests large and small disks and rods are intermingled. In other tests larger, and fusiform rods, probably diatomes, are mingled with disks, as in Fig. 5.

Between the structural forms of the tests indicated, all sorts of intermediate forms are found. Occasionally, mingled with the more intrinsic elements of the tests, there are undoubted diatome cases, and rarely distinct and comparatively larger particles of siliceous sand.

Fig. 5.

Prof. L. looked upon the disks and rods of the test of Nebela as intrinsic structural elements. They appear to be siliceous, as they undergo no change in heated sulphuric acid. No similar elements could be detected among the ordinary materials among which the animals lived.

Dr. Wallich regards the disks and rods, of the forms he has called *Difflugia pyriformis* var. *symmetrica*, as being derived through the metamorphosis of diatome cases, through the combination of these with the basal substance of the test. In the reference to his figures 27 to 33 *An. and Mag. Nat. Hist.* 1864, pl. he says that they "represent the series of forms exhibiting the transition from the ordinary mineral and chitinoid elements of the test to the evolution of the colloid disks." Prof. L. remarked that notwithstanding he had examined multitudes of Nebela, he was not prepared to confirm this view, though he had too much respect for Dr. Wallich's accuracy of observation to doubt its correctness.

The figures 1–4 represent ordinary forms of *N. numata;* and

Figure 5 the relative compression of the test. Figure 6 is the form described as *N. flabellulum*, which may be regarded as an extremely broad variety of the former. Figure 7 represents the relative thickness of the same test. Between the forms referred to *N. numata* and *N. flabellulum*, all sorts of transitional ones occur. Figures 8, 9 exhibit two views of a narrow form of *N. numata*, which resembles the *Difflugia binodis* of Ehrenberg.

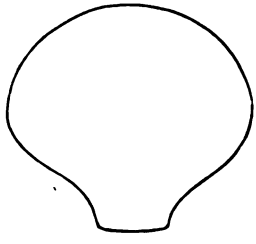


Fig. 6.

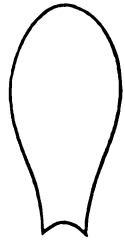


Fig. 7.

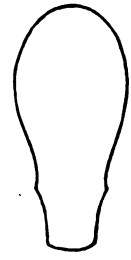


Fig. 8.

Fig. 9.

Figure 10 represents an outline view of *Nebela carinata*, or *Difflugia carinata* of Archer, from sphagnum of New Jersey. Figure 11 represents a transverse section. Figure 12 *Nebela equi-*

Fig. 11.

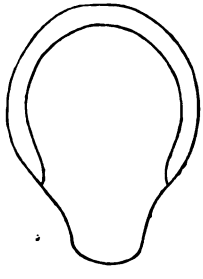


Fig. 10.

Fig. 13.

Fig. 12.

Fig. 14.

Fig. 15.

calceus, a transitional form from *N. carinata*. Figure 13 a transverse section. Figure 14 *Nebela ansata*, which looks as if it were derived from the former by the loss of the horse-shoe-like ribs. Figure 15, another form observed, unnamed, in which, instead of the horse-shoe of Figure 12, there are two hook-like processes projecting in the interior of the test. Figures 16, 17 outlines of *Ne-*

bela sphagni. Figure 18 *Nebela barbata.* For characters of the species see *Proc. Acad. Nat. Sci.* 1874, 156.

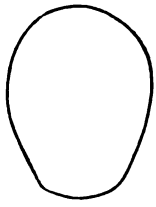


Fig. 16.

Fig. 17.

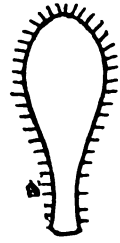


Fig. 18.

On Certain Trap Rocks from Brazil.—Prof. PERSIFOR FRAZER, Jr., stated that during a recent engagement by the Commission of Brazil to the International Exhibition, now being held here, to examine and arrange the ores, minerals, and rocks of that country, a number of traps were obtained, of which thin sections had been submitted to a preliminary investigation.

These have been studied without the aid of chemical analysis, and the results, so far, are hereby laid before the Academy.

It is evident that this mode of determination cannot by itself be exhaustive, but it is believed that some new facts are hereby added to our knowledge of the igneous rocks of the globe, and a close analogy between certain species of North and South America made out. It was not possible to ascertain the localities in all cases. The following is a partial list:—

No. 580.—Between Casa Branca and Rio das Pedras.

No. 587.—Between Ouro Preto and Casa Branca.

No. 610.—From Resaquinha.

No. 790.—Procedencia Morrotos.

The following is a hasty glance at their mineral constituents:—

No. 279.—*Dolerite.* Labradorite, Pyroxene, Chlorite, and Magnetite.

No. 580.—Pyroxenite rock, with microliths.

No. 587.—Pyroxene and Biotite.

No. 591.—Decomposed mass, containing Pyroxene and Magnetite.

No. 610.—Chlorite, with concretions of Ferric Hydrate.

No. 635.—Under 230 diameters, and without polarized light, the "flowing" structure is well shown.

Between crossed Nicol's prisms the lines which resemble microliths exhibit an intricate network and polarize from white to light blue. Under 1080 diameters the above lines seem to be corrugations or clefts in the mass, while a new set of minute black and brown prismatic crystals come into view, indicating by the gradual curve in the line of their direction also a "flow

structure." Chrysolite (*Olivine*) and Mica appear to be present in this specimen.

No. 665.—Labradorite rock, with bundles of microliths. Containing also pyroxene and magnetite.

No. 684.—With an enlargement of 350 diameters and between Nicol's prisms this specimen exhibits Labradorite and Pyroxene (one beautiful main section of the latter). The blades of labradorite are smaller and the pyroxene less distributed through the mass than in No. 706.

Another mineral not certainly determined polarizes from green to black.

No. 692.—Pyroxene in a vitreous paste, containing Chlorite.

No. 706.—With a magnifying power of 230 diameters this section exhibits a mass of brown and reddish-brown fragments of irregular shape.

The cross fractures are numerous and irregular. Various angles of fracture were found to give 84° 47′, 78° 51′, 73° 20′, 53° 59′, and 88° 28′, but the micro-goniometer employed could not be relied on for angles of less than 1°.

The latter of these measurements is sufficiently near the prismatic angle of Augite (*i. e.* 87° 5′), to suggest the presence of that mineral.

Many slabs of Labradorite are associated with it, each of which is readily detected by its characteristic mode of twinning.

Black masses of Magnetite are strewn through the field of view, and some rod-like Apatite.

Under 350 diameters more crystals of Apatite appear.

With *one* prism, isolated spots of the mineral first described show feeble dichroism. *Dolerite.*

No. 769.—Decomposed Pyroxene, with Magnetite and Labradorite. The specimen shows signs of the passage of Dolerite into a rock more nearly resembling Diabase from the presence of a chloritic material (perhaps the "Diabantite" of Hawes), and its generally decomposed appearance.

No. 786.—Under 1080 diameters Chlorite and Pyroxene are visible, together with a white, pasty glass.

No. 790.—Feldspar, Olivine, Magnetite, and Apatite.

No. 795.—*Dolerite.* Consists of Pyroxene, Magnetite, Labradorite, and large numbers of Apatite crystals.

(The sections of the Magnetite and of the Apatite crystals are very fine.)

Feeble dichroism is observed in spots on the Pyroxene. No Mica visible.

No. 795.—Pyroxene, Magnetite, Labradorite, and a large number of Apatite crystals.

x. Magnetite, Chrysolite, Labradorite, and some Pyroxene.

x′. Labradorite, Pyroxene, Magnetite, and Apatite. *Dolerite.*

Thin sections of these rocks and also those of similar character from Pennsylvania were projected on the screen in polarized light and compared.

Harvey Fisher, Geo. A. Wright, A. C. Lambdin, M.D., John Russel, J. C. Martindale, and A. E. Brown were elected members.

The following papers were ordered to be published:—

ON CERTAIN MEXICAN METEORITES.

BY MARIANO BARCENA.

At the last meeting of the Academy, Prof. Smith having spoken of an aerolite from Chihuahua, I have thought proper to relate some facts about other Mexican meteorites.

Certainly, my country is most abundantly provided with these meteoric masses; to the present time they have been found in the States of Chihuahua, Sonora, Sinaloa, Nuevo-Leon, Coahuila, Zacatecas, Durango, San Luis Potosi, Mexico, and Oaxaca.

The most notable masses which have been discovered in Chihuahua are found in the "Concepcion hacienda," and in a place called "Chupaderos." I have seen two pictures of one of the meteorites of the former place, and, according to the explicatory scale which the drawing had, I could judge that it was of great dimensions; its form, like that of all the meteorites of Mexico, tends to that of a prism of curved faces, and presenting various irregularities. They have assured me that the mass which is found in Chupaderos is of greater dimensions than the one I have mentioned.

Other meteoric irons of various dimensions are found in the vicinity of the "Presidio del Principe," in the same State of Chihuahua. The National Museum of Mexico possesses various facts about these masses, and probably will get some of the latter, as the inhabitants of that State have promised to send some of them.

The Mexican Society of Natural History of the City of Mexico received last year a picture and some small fragments of an enormous meteoric mass lately discovered in the State of Sinaloa. Although I do not remember at present its exact dimensions, still I can assure the Academy that its length was more than twelve feet. I have commenced to analyze that meteorite, and I will conclude the work on my return to Mexico. Like those to which I have referred, it belongs to the class of the SIDERITES of Mr. Daubrée—as it is composed essentially of iron and nickel. It is of a silver-white and grayish color.

The aerolites of Nuevo-Leon and Coahuila were found in

"Santa Rosa" and in the "Potosi." The facts we have regarding them are few and insignificant.

From Zacatecas they have taken to Europe various samples of meteoric irons; one of them was analyzed by Clark, and had the following composition:—

Iron	86.09
Nickel	9.96
Chromium	0.67
Sulphur	0.84
Magnesia	0.19
	97.75

Baron Humboldt and other persons have also carried to Europe some samples of meteorites from Durango. The analysis made by Mr. Damour of the aerolite of the Mezquital is known; the composition is the following:—

Iron	93.38
Nickel	5.89
Cobalt	0.39
Phosphorus	0.23
	99.89

In the National Museum of the City of Mexico exists another meteoric mass, which came from the "Cascaria" hacienda in the State of Durango. It is composed in great part of iron, and, on attacking its surface with acid, the figures of Widmastaeten appear very clearly—the dominant form of these figures being quadrilateral.

In the State of San Luis Potosi two aerolites of large dimensions were found. One of them, called "Meteorito de la Descubridora," was sent four years ago to the Mexican Society of Geography and Statistics of the City of Mexico, by Messrs. Cabrera and Yrizar of the City of San Luis Potosi. This mass, which weighed 576 kilogrammes, was divided in several pieces for the purpose of making some investigations as to its structure. The form of the meteorite was also prismatic; it resembled that of a pyramid with a triangular base; the drawing taken with a photographic apparatus presented in its outline several lines well determined, which formed triangular and quadrilateral figures very similar to those produced by hydrochloric acid upon the polished surface of the same mass. The color of the aerolite is

grayish-white, and its texture is notably crystalline. Its specific weight is 7.38. It is composed of

Iron	89.51
Nickel	8.05
Cobalt	1.94
Sulphur	0.45
Chromium	trace
Loss	0.05
	100.00

The resistance of that iron to rupture by compression is 38 kilogrammes to the square millimetre; the resistance to the rupture by extension is 40 kilogrammes, being the section of the metallic thread of a square millimetre. The coefficient of lineal dilatation between 0° and 100° is 0.0000701.

The analysis of the meteorite in question was made by the Mexican chemist, Don Patricio Murphy; the other studies were made by a commission, of which I had the honor of being a member.

My learned friend, Prof. James D. Dana, of New Haven, possesses a fragment of this meteorite, which I sent to him, and in which the figures of Widmasstaeten are perfectly formed. The meteoric iron of the "Descubridora" is also very notable for the many cavities which it has in its interior, and which are occupied by the troilite or proto-sulphide of iron. It presents itself under the form of a crystalline powder of a bronze-yellowish color.

Another meteorite from the State of Zacatecas, which was found in the vicinity of "Charcas" was taken to the Museum of Paris by the French army. Its form is like that of a triangular pyramid. Its analysis was made by Prof. Mennier, and is as follows:—

Iron	93.01
Nickel	4.32
Insoluble matter in acids	0.70
	98.03

In the State of Mexico have been found several meteorites called "Ocotitlan," "Toluca," "Yxtlahuaca," and Xiquipilco." The first three were taken to Europe: the "Ocotitlan" was studied by Profs. Burkart and Bergeman, who, on analysis, found the following composition:—

Iron	85.49
Nickel	8.17
Cobalt	0.56
Insoluble matter in acids comprising Schreibersite, Graphite, etc.	5.00
	99.12

In Xiquipilco the meteoric irons are very abundant, and all proceed probably from a great mass which was broken into pieces. A sample from that locality analyzed by Mr. Pugh had the following composition:—

Iron	90.43
Nickel	7.62
Cobalt	0.72
Phosphorus	0.15
Sulphur	0.03
Copper and tin	0.03
Schreibersite	0.56
Graphite	0.34
	99.88

The specimens of a meteoric iron from Xiquipilco are very remarkable for their crystalline structure. Schreibersite is found under the form of white and flexible laminæ determining octahedral cleavages. In the same collection which the Mexican Society of Natural History of the City of Mexico sent to the International Exposition, is found a sample of iron from Xiquipilco, in which I discovered a part of a regular octahedron, raising the laminæ of the Schreibersite, which are located in perfect regularity on the specimen.

The National Museum of the City of Mexico sent also to the Exhibition a sample of meteoric iron from the same locality; in it is observed an oxidized layer which presents several green spots produced by the compounds of nickel which it contains. That layer to which I refer is characteristic of the iron from Xiquipilco.

In the State of Oaxaca have been found two very remarkable meteoric masses, which are distinguished by the names of "Mixteca Iron" and "Yanhuitlan Iron."

The first was studied by Profs. Burkart and Bergeman; its composition is the following:—

Iron	86.857	
Nickel	9.917	
Cobalt	0.745	
Phosphorus	0.070	
Sulphur	0.553	0.524 carbon and iron.
Insoluble residue in the acids	0.975	0.451 { 0.053 phosphorus. 0.133 nickel. 0.265 iron.
	99.117	

The meteorite "Yanhuitlan" is found at present in the National Museum of the City of Mexico. It was found in the vicinity of Yanhuitlan, by some countrymen when they were tilling the soil, at the foot of a hill called Deque-Yucumino. Its weight is 916 pounds.

The figure of this mass is very interesting, as it approaches remarkably to that of a tetrahedron. Its color is grayish-white. Its specific weight is 7.824, and its composition, discovered by the celebrated Mexican chemist, Don Leopoldo Rio de la Loza, is the following:—

Iron	96.58182
Nickel	1.83200
Volatile substances	0.36210
Silicious sands	0.00560
Carbon	0.00018
Lime	0.60815
Alumina	0.61015
	100.000

There are other facts about several meteorites from Mexico, but the places where the latter are found are not well determined.

That peculiar property, difficult of explanation, which the Mexican soil has in attracting the meteoric irons, is even noticed at present; numerous are the shooting stars which cross the atmosphere of that republic, and more especially in the months of August and November. This phenomenon, which is also observed in other parts of the world, I have seen on various occasions in my country. Lately one of those shooting stars came against a summer-house in the State of Puebla, causing much damage to the occupants.

The studies which may be made beforehand of the physical characters and the chemical composition of the meteorites of Mexico, will group the latter in series, and will refer many of them, perhaps, to the same origin, as it is the case with the "Xiquipilco" meteorite, which, by its crystalline structure and other properties, may be thought to proceed from the same mass.

ON THE OCCURRENCE OF HELIX TERRESTRIS, CHEMNITZ, IN NORTH AMERICA.

BY WM. G. MAZYCK.

In July, 1875, I accidentally discovered a number of dead shells of Helix terrestris, Chemnitz, in St. Peter's (Episcopal) churchyard, Logan Street, Charleston, S. C., but, notwithstanding a most diligent search, no living examples of the species could be found at that time, owing probably to the prevalence of an almost unprecedented drought.

In September, I was, however, fortunate enough to secure two living specimens; which were sent to my friend Mr. W. G. Binney for examination, who kindly furnishes the following description of the jaw and figures of the lingual dentition:—

"Jaw slightly arcuate, low, wide; ends blunt, slightly acuminate; anterior surface with over 14 broad, crowded, flat ribs, slightly denticulating either margin."

Von Martens (Albers' Heliceen, p. 116) places the species in the sub-genus Turricula, Beck, giving as the habitat, "Italy and Southern France." I have never heard of its occurrence elsewhere until its discovery in Charleston, where it exists, as far as I can ascertain, only in St. Peter's churchyard, accompanied by *Helix aspersa*, Müller, *H. Hopetonensis*, Shuttlw., *Zonites minusculus*, Binney, *Pupa marginata*, Say, and *Stenogyra decollata*, Linnæus, which latter is exceedingly abundant throughout the city.

St. Peter's Church was burnt in the great fire of December 12, 1861, at which time the greater portion of the shrubbery of the graveyard was also destroyed. The ruins of the building were removed about two years ago, and, the shrubbery not having been renewed, there is but little shade, a circumstance which has, doubt-

less, greatly retarded the propagation of the species which has probably existed in small numbers for several years in this very restricted locality.

I am indebted to Mr. Thomas Bland for the determination of the specific name.

Specimens of the dead shells have been deposited in the Museum of Comparative Zoölogy, Cambridge, Mass., in the cabinets of Mr. W. G. Binney and Mr. Thos. Bland, and may be seen in my own collection.

FOURTH CONTRIBUTION TO THE HISTORY OF THE EXISTING CETACEA.

BY E. D. COPE.

Grampus griseus, Cuvier. Pl. III.

A specimen apparently belonging to this species was taken by the United States Commission of Fisheries off the coast of Massachusetts. Its appearance may be learned from the accompanying plate, which is copied from a drawing made on the spot by the artist of the Commission. Its length is five feet five inches; the length of the pectoral fin, measured along its median line, is nine inches.

Globicephalus brachypterus, sp. nov.

Globicephalus? sp. nov., Cope, Proceedings Academy Philadelphia, 1866, p. 8.

A female of this genus was taken by fishermen, in February of the present year, on the east coast of Delaware Bay, at the mouth of Maurice River, and was sent to this city, where it fell under my observation. Its uninjured condition offered an opportunity of making a description of its external proportions and appearance. This had been a desideratum, since the examination of a cranium several years ago had led me to suspect that the blackfish of the middle and southern Atlantic coasts of the United States is a different species from the *Globicephalus melas* of the northern coasts of both continents.

The measurements of this specimen are as follows:—

	Feet.	In.
Total length, measured along the side	12	6.5
Length to base of dorsal fin		87
Length of base of dorsal fin		24
Elevation of the dorsal fin		9
Length of the pectoral fin		25.5
Greatest width of pectoral fin		7
Width of thorax between pectoral fins		18
Depth at middle of dorsal fin		35
Length from vent to end of tail (on convexity)		52
Depth of caudal peduncle half way between anus and end of tail		22
Expanse of flukes		43

The color is a uniform black, without any markings whatever.

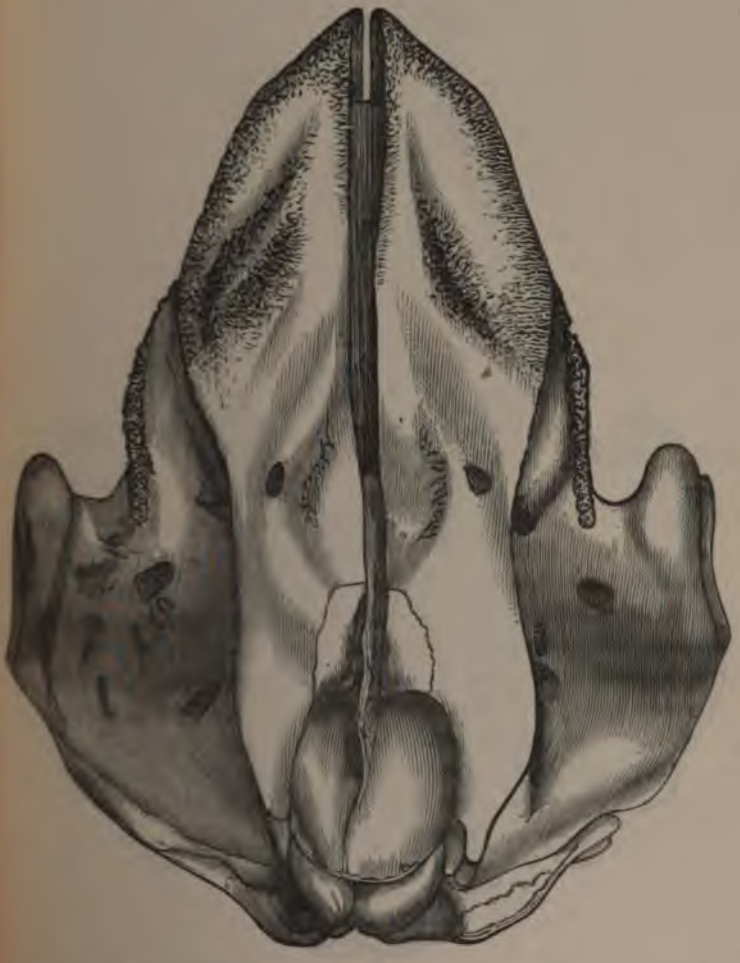
The profile of the head has the protuberant convexity of the other *Globicephali*, with a very narrow projecting lip. The general form of the body is elongate, more so than in the *G. melas;* and the dorsal fin has a more anterior position. Instead of standing near the middle of the length, it rises at the end of the anterior fourth of the length. Its base is unusually long, and its elevation not great. Its superior border is convex, and the apex decurved behind so as to be slightly descending. The posterior or caudal part of the body is much compressed, and maintains its depth with a very gradual diminution until near the flukes, where it contracts more rapidly. The blow-hole is situated at a point less than half way between the points opposite the eye and front base of pectoral fin; it forms a fissure, which presents a shallow concavity forwards. The anterior base of the pectoral fin is situated at the anterior third of the distance between the blow-hole and the front border of the dorsal fin. It is characterized by its relatively small size, and offers one of the distinguishing features of the species. It enters the total length six times, while in the *G. melas*, according to Van Beneden, it enters the total 4.5 times in a fully grown fœtus, and the length increases with age, according to Flower, so that its proper length would be about one-fourth of the total. This measurement nearly agrees with that given by Dr. Jackson, as obtained by him from a specimen from the New England coast, which I suppose to belong to the *G. melas*. In a specimen taken by the U. S. Fish Commission, the length of the pectoral fin is nearly as in the *G. brachypterus*. This probably represents the *G. intermedius*, Harl., and has a white abdominal band, and light gular areas.

The teeth in the specimen from Maurice River are small, and number five in the upper jaw and six in the lower. There is a mammary fissure on one side of the vulva, and a fissure with an additional fold on the other side.

The skeleton of this specimen presents several interesting characteristics. The cranium differs from that of *G. melas* in the anterior lateral expansion of the premaxillary bones, so that they entirely conceal the maxillaries when viewed from above. This character is not seen in numerous specimens of the *G. melas* from Cape Cod. The front teeth are less firmly implanted in alveoli than those of the *G. melas;* thus on one side of the maxillary bone, four alveoli are filled with osseous deposit; and on the

other side, one. The cervical vertebræ are all coössified, and they present no parapophyses, and but one diapophysis on each side (the seventh). Three segments of the sternum are preserved, which are longer than broad, the anterior two coössified. The first

Fig. 1.

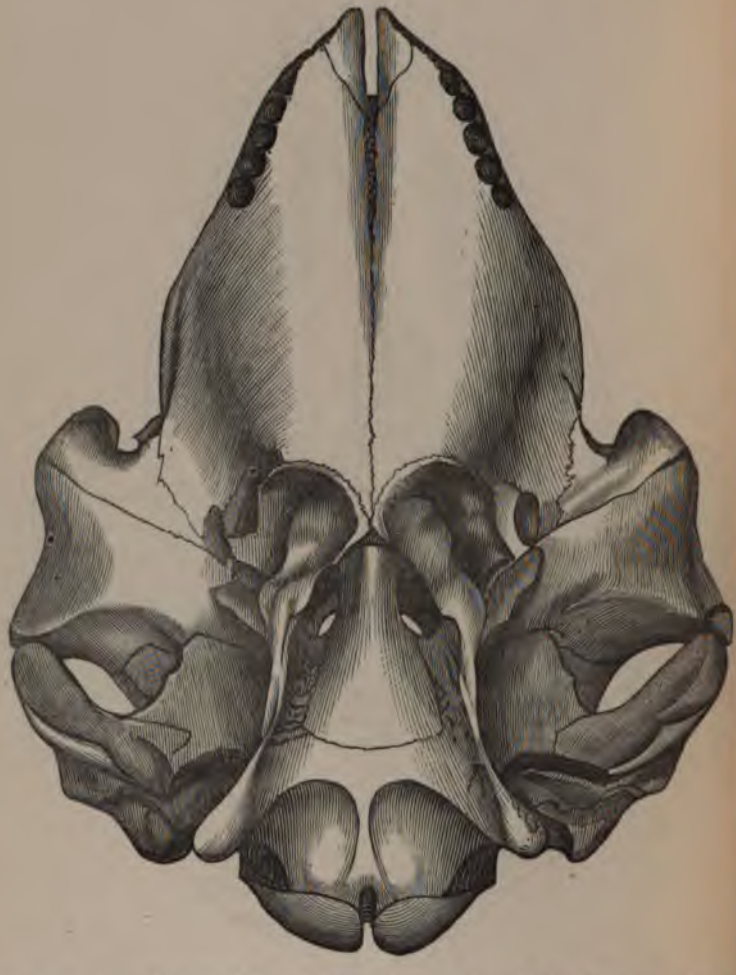


one is furnished with recurved antero-lateral processes, and is divided in front by an oval foramen. The scapula is as wide as high; it presents a rather long, truncate, coracoid process, and a

prominence of the proximal part of the spine, which represents the acromion.

The cranium which I formerly described (Proceedings Academy Philada., 1866, p. 8) is that of an adult of full size. I remarked

Fig. 2.



at that time that it differed from the crania of the *G. melas* from the European and New England coasts in the greater width of the premaxillary bones, which extend to the lateral borders of

the basal two-fifths of the maxillaries; and also in the small number of maxillary teeth, there being only five alveoli in the upper jaw. The existence of the same number of teeth in the

Fig. 8.

specimen now described proves that this small number in the adult is not due to shedding, or connected with age, and it is probably a constant character of this species. In the *G. melas*

there are ten teeth in the maxillary bone, as I have observed on numerous specimens from the New England coast.

In review, the *Globicephalus brachypterus* is characterized by the short pectoral fins, the few teeth, the wide premaxillary bones, and the absence of white band along the median line of the lower surfaces. The anterior position of the dorsal fin is also probably characteristic. In the two characters first enumerated, it approaches the genus *Grampus* more nearly than does any other well-known *Globicephalus*.

The cuts represent the profile and superior and inferior surfaces of the skull of the larger individual above mentioned.

Phocæna lineata, sp. nov.

This new porpoise is represented by a single specimen, which was taken in the harbor of New York not many months ago, and sent to the Smithsonian Institution, where the skeleton is now preserved. Under direction of Professor Baird, a plaster cast of the animal was made and colored directly from the specimen, with the excellent result of offering a means of study more reliable than the dried skin, where the form is likely to be distorted from various causes, and the color changed by the action of the oil. A large number of skeletons and two plaster casts of the common porpoise of our coast (*Phocæna brachycium*) having also been prepared under the direction of Prof. Baird, ample means for the comparison of the two species exist. The Smithsonian collection embraces also two crania of the *P. communis* from the Norwegian coast, and two of the *P. vomerina*, Gill, from Puget Sound, Washington Territory.

A comparison of these crania develops the following distinctive characters of three species. I may premise that a second cranium in the Smithsonian collection, and one in the museum of the Philadelphia Academy, agree in characters with that of the *P. lineata*.

Phocæna communis, Brookes (Nos. 3507-8).

Vomer not at all or very little exposed behind posterior border of palatine bones, which are not separated from the pterygoids by deep entrant notches.

Phocæna brachycium, Cope (*P. americana*, Agass., fide Verrill; not described), Proceed. Acad. Philada., 1865, p. 279.

Vomer with a narrow transverse protuberance behind the palatines, which are separated from the pterygoids by a deep notch.

Phocæna lineata, Cope, sp. nov.

Vomer with an extensive development behind the posterior margin of the palatine bones, forming an inverted table; the pterygo-vomerine outline forming an M.

The skull of the *P. vomerina*, Gill, differs in no appreciable degree from that of *P. brachycium*, and it remains to ascertain in what respect other parts of its structure present distinctive characters.

The *Phocæna lineata* presents various features which distinguish it from the *P. brachycium*. The body is relatively larger and longer, the length of the cranium entering the total six times; while that of *P. brachycium* is only one-fifth the total length. The base of the pectoral fin is situated more than half way between the end of the muzzle and the line of the anterior base of the dorsal fin. The dorsal region and border of the dorsal fin are entirely smooth, in the cast as in life, according to my friend, G. Brown Goode, of the U. S. Fish Commission, who examined the skin. There are twenty-four teeth of the typical form in each ramus of the mandible.

The color of this porpoise is quite characteristic. The upper surface to the middle line of each side is black. This color is bounded below from a point behind and below the eye to a foot in front of the end of the tail by a rosy-brown. The lower surfaces are whitish. The pectoral fin is black, the color being isolated from the black of the sides by the white and rosy colors described. Its black color is continued forwards and upwards as a narrow band to a point about three inches below the eye.

In the following measurements some comparisons are made with the *P. brachycium*.

	Inches *P. brachycium.*	Inches. *P. lineata.*
Total length	47	68
Length of skull	9.3	11
Length to base of dorsal fin	21	30
Length to posterior base pectoral	12	17
Width of skull at notch		3
Width of skull above orbits		5.6
Elevation of cranium		5
Length of head to below blow-hole		6
Length of head to eye (inclusive)		7.6
Length of posterior edge of pectoral fin		6.6
Elevation of dorsal fin		4

In further comparison with the *P. brachycium* I may add, that the casts preserved in the Smithsonian collection show that the colors of that species are widely different from those of *P. lineata*. They are black above, and the belly has a narrow yellow longitudinal band, which fades into a lead-color on the sides which commences at the axilla, and is marked with numerous brown spots. The sides of the throat are black, and this color continues posteriorly and involves the entire pectoral fin and parts immediately above it on the side. This specimen with numerous crania is from Eastport, Maine.

This, or a nearly allied species, is stated by F. Cuvier (Cetacea, p. 171) to be found on the European coast. The relative length of the head to the body is as in *Phocæna lineata*, and his fig. 1, pl. xii., represents a coloration nearly similar to the individual from New York Harbor. He does not distinguish it from the *P. communis*, although it differs entirely from the descriptions of that species.

Lagenorhynchus perspicillatus, sp. nov.

This species is represented in the collections of the Smithsonian Institution by numerous crania, some skeletons and a colored cast of the natural size, taken by the United States Commission of Fisheries, near Portland, Maine. Professor Baird, Chief of the Commission, states, that it is an abundant cetacean, and the fact that it has been hitherto unrecorded is doubtless due to the absence of facilities for obtaining these creatures, within reach of naturalists.

The species belongs to the *Delphinidæ* without palatal grooves (*Lagenorhynchus*, Gray), and to the section with flat muzzle of the cranium, and short beak of the integuments of the head.

The muzzle is longer than the brain case, measured internally, and a little longer than the cranium posterior to the maxillary notch. The occiput is convex, and the basal premaxillary triangle is an oblique plane a little elevated above the maxillaries at the sides. The anterior part of the triangle is rugose, and extends to the end of the basal fifth of the muzzle, measuring from the notch. In this portion the muzzle is flat with slightly recurved edges; in the remaining part, the section is depressed roof-shaped. Teeth $\frac{30}{30}$ acute, curved, directed outwards, and of medium size. The palate between the pterygoid bones is concave. The last tooth reaches to within an inch of the fundus of maxillary notch, and at

that point the sides of the palate slope obliquely upwards and outwards. The measurements of the cranium are as follows:—

	Inches.	Lines.
Total length	16	
Length of brain case (internal)	4	6
Length of muzzle to notch	8	9
Length to blow-hole	11	
Width of muzzle at notch	4	6
Width of cranium above orbits	8	2
Width of muzzle at distal fourth	2	3
Length of a tooth beyond alveolus		5

The general outline of this species is fusiform. The beak is well marked, and separated from the front by a groove. The front does not rise abruptly, but slopes gently backwards in continuation of the dorsal line. The dorsal fin is higher than long, and its apex is not decurved. The caudal peduncle is compressed and descends rather abruptly to the flukes. The typical specimen is about six feet in length.

The dorsal region is black to a line which begins in front of the eye, extends along the sides above their middle, and descending includes the entire caudal fluke. From the latter it sends forwards a narrow horizontal bar to a point half way to the dorsal fin, and which does not reach the abdomen. In front the black includes the entire upper lip, and sends posteriorly a short bar which includes the eye. The edge of the lower lip and the pectoral fin, with a line from the latter nearly to the former, are also black. The sides are a lead color as far as a line which leaves the lower-lip border at the middle, extends above the pectoral fin, descending by a Z-shaped border below the posterior edge of the dorsal fin, and extends to the black longitudinal bar of the caudal peduncle. Below this the surface is white.

The typical specimen is six feet in length.

This dolphin is, according to the descriptions, allied to the *L. acutus* of Gray (*D. eschrichtii*, Schleg.), especially in the characters of the cranium. The descriptions of the coloration of that species are quite different from that of the *L. perspicillatus*. A figure given by M. Poelman (Bulletin Acad. Royal Belgique, xvii. p. 608) represents the black longitudinal band of the caudal peduncle of *L. perspicillatus* to be extended forwards so as to unite with the black of the dorsal region on the side, thus inclosing above it a longitudinal white and pink area. The black

of the upper surfaces also involves the eye, which is, therefore, not surrounded by the spectacle-like mark of the *L. perspicillatus*. Other material differences in the coloration are also apparent. The colors of the *L. leucopleurus* are more like those of the present animal; but here also the black line of the side extends far forwards, and there is a short black line through the eye instead of the spectacle-like figure. The measurements of the skull differ from those of this species, and agree with those of the *L. acutus*, as given by Dr. Gray. (See Annals and Magaz. Nat. Hist., 1864, 133, pl. 3.)

Lagenorhynchus gubernator, sp. nov. Pl. IV.

This delphinoid was taken by the U. S. Fish Commission at near the same locality as the last. Two plaster casts were made and colored from the fresh specimens. These display differences from those of the *L. perspicillatus*, which are doubtless specific, although the two are nearly allied.

The typical specimens are about half the bulk of those of *L. perspicillatus*, measuring forty-seven inches in length. The muzzle is neither elongate nor very short, and is well marked off from the front, which rises more abruptly and is more convex than in the larger animal. The dorsal fin is longer than high, and the anterior border becomes horizontal above, so that the apex is directed posteriorly. The post-dorsal region is strongly compressed, and maintains its width more nearly to the base of the flukes, making a more abrupt contraction than in *L. perspicillatus*.

The description of the coloration of the *L. perspicillatus* applies to that of *L. bombifrons* with the following important exceptions: The white of the belly extends upwards to the dorsal coloration, entirely excluding the lead color so prominent in the *L. perspicillatus*. The black bar, which extends forwards from the flukes, reaches to below the posterior base of the dorsal fin, and extends also to the belly at its base, neither of which characters is observed in *L. perspicillatus*.

The measurements of this species are as follows:—

	Inches.
Total length	47
Length to the eye	6
Length to posterior basis of pectoral fin	11
Length to anterior basis of dorsal fin	18
Depth of caudal peduncle just anterior to the contraction	5

It is not necessary to compare this species with the *L. acutus* and *L. leucopleurus*, since, in those respects in which it differs from *L. perspicillatus*, it is the more widely distinct from them.

EXPLANATION OF PLATES.

Plate III. Fig. I. Grampus griseus.
Figs. 2 and 3. Heads of two individuals.
Plate IV. Lagenorhynchus perspicillatus.

JULY 4.

The President, Dr. RUSCHENBERGER, in the chair.

Seven members present.

A paper entitled "Description of a New Species of Ægiale, and Notes on some other Species of North American Lepidoptera," by Herman Strecker, was presented for publication.

JULY 11.

The President, Dr. RUSCHENBERGER, in the chair.

Thirteen members present.

JULY 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

Halloysite from Indiana.—Mr. E. GOLDSMITH remarked that a considerable deposit of a clay-like mineral has been observed near Huron, Lawrence County, Indiana. He had been informed that the deposit is nine feet thick; this, however, seems to be exaggerated, since Prof. E. T. Cox, in the 6th Annual Report of the Geological Survey of Indiana, makes it but four to six feet. It occurs in the carboniferous formation, 103 feet below the surface. Its roof is the millstone grit.[1] The floor is reported to be iron ore four feet thick. In regard to the breadth and length nothing seems known. In the Main Exhibition Building, also in the Mineral Annex of the International Centennial Exhibition, an *exposé* of this fine porcelain ore is made. Having been informed that Prof. Cox had called it Indianite, he had made an investigation of its physical and chemical properties before seeing any notice of the mineral in print.

The substance is amorphous; fracture subconchoidal; thick pieces are perfectly opaque; on the edges some light passes through; it is, therefore, subtranslucent, but the material becomes transparent if lying in water, of which it absorbs much. At the same time it cracks into small sharp-edged fragments. These, when taken out of the water and dried, lose the transparency, and become subtranslucent again. Lustre waxy, in some

[1] The stratification is illustrated by a diagram in the same volume.

places dull; the lustre increases if the substance is rubbed with a smooth harder material. He had noticed irregular cracks which traverse the specimens. Streak colorless; its cohesion is weak; H = 2.5; S. G. = 2.16. It is odorless, and adheres somewhat to the tongue. Color, white. The blowpipe reactions indicated the presence of water, alumina, and silica, and nothing else could be detected in the qualitative analysis in the wet way.

The "air-dry" substance, having been very finely pulverized, was heated in a platinum crucible at a white heat over a Bunsen-burner until two consecutive weighings were equal. It lost, thus treated, 24.15 per cent. of water. Through the above-described properties, it is easy to determine the name of the species, for Pholerite contains 15 per cent. of water; Kaolinit about 13 per cent.; Halloysite about 26 per cent.; and Samoite 30 per cent. The species is Halloysite; but, in order to be positive as regards the ratios of the other elements, he had requested Mr. W. H. Dougherty to make the quantitative determinations of the constituents. This analyst found, by experiment, that boiling sulphuric acid is the best decomposer of this mineral, and having worked repeatedly with other decomposers without satisfactory results, the sulphuric acid plan was adopted. The samples analyzed were "air-dry," the normal condition of the mineral in nature.

The result of the quantitative analysis is as follows:—

Silica . . .	38.80	per cent.,	which contains	20.425	per cent.	of	oxygen.
Alumina . .	35.20	"	"	"	16.408	"	"
Water . . .	25.74	"	"	"	22.880	"	"

The oxygen ratios of the three oxides—

$$\dot{S}i : \ddot{A}l : \dot{H} = 4 : 3 : 4$$

nearly, which affords the formula—

$$\ddot{A}l\,\dot{S}i^{2} + 4\dot{H}.$$

This formulated expression requires—

$\dot{S}i = 40.6$ per cent.; $\ddot{A}l = 34.9$ per cent.; $\dot{H} = 24.4$ per cent.

In the list of analyses of Halloysite, reprinted in Dana's Descriptive Mineralogy, we find that the amount of water observed by the authors varies between 16 per cent. and 26 per cent., the former number having been obtained on drying the substance at 100° C. prior to the determination of the water. That Mr. Dougherty found more water than he had obtained is due to the fact that the former gentleman used the blast for removing the water.

Prof. E. T. Cox states in his report that this mineral had been analyzed by J. Lawrence Smith, M.D., with this result:—

$\dot{S}i = 45.90$ per cent.; $\ddot{A}l = 40.34$ per cent.; $\dot{H} = 13.26$ per cent.;

which is the composition of Kaolinite; but how this analysis had been performed, and especially why only 13.26 per cent. of $\dot{H}$ had

been obtained, the reader is left uninformed. He presumed that the mineral sample must have been prepared previous to ignition, or, in other words, the sample was dried strongly, and no account taken of the loss sustained. Under such conditions the quantity of $\dot{H}$ is less, whilst the other constituents become more.

The reason why this mineral is a new species, and not Kaolinite, Prof. E. T. Cox endeavors to explain in this way: "Kaolin is entirely derived from feldspar and feldspatic rocks, such as granite and porphyry, etc.; but the porcelain clay of Lawrence County has resulted from the decomposition, by chemical water, of a bed of limestone and the mutual interchange of molecules in solution, brought about by chemical precipitation and affinity."

The proofs, however, have been omitted, and, therefore, the view cannot be accepted, since Bischof (in his Chemische Geology, B. II., p. 428) has shown that the various clays are derived from the decomposition of feldspar.

Retardation of Bloom in an Herbaceous Plant.—Mr. THOMAS MEEHAN made note of a plant of *Senecio Jacobæa*, which in his garden did not bloom till fifteen years old, in this respect somewhat rivalling the Century plant, *Agave Mexicana*, which sometimes flowered at that age.

Mr. Martindale reported the *Senecio* as being found among the ballast plants at Kaighn's Point, and had seen plants at least two years old that had not bloomed.

Cross Fertilization in Campanula.—Mr. MEEHAN remarked that when the subject of insect cross-fertilization was before the Academy a few evenings since, he admitted that some plants seemed to require the aid of insects, and he had conceded *Campanula* as being of this small list of exceptions. Since then, having had reason to suspect this conclusion, he had confined flowers of *C. pulcherrima* in fine gauze bags, and they had seeded perfectly. He had no hesitation in saying that those who had claimed *Campanula* as illustrating the necessity for cross-fertilization by insect agency were wrong. He admitted that it was difficult to understand from the structure alone how self-fertilization was effected, but that it was so effected was certain, and careful study would no doubt explain it Composites were claimed as proving cross-fertilization—it might explain the *Campanula* case to note how self-fertilization in chicory was effected. He had recently been able to discover this. The chicory has blue pistils as well as blue corollas, and as the rather large pollen grains are of a pure white, they afford an excellent chance for observation. The whole growth and fertilization is over in about a couple of hours, so that one need not spend much time in the study. About 6 o'clock in the morning the pistil with the closed lobes elongates, pushing through the mass of pollen, and carrying quantities with it, all over its whole surface. About an hour after, the lobes expand, and the pollen falls into the cleft and on

to the stigmatic surface. The flowers close entirely by nine or ten o'clock of the same day, the work of fertilization being wholly finished. Pollen-eating insects visit the flowers, but these can be kept away during the few hours of observation required, and it would be found that all the flowers had pollen on the stigmatic surfaces nevertheless.

Variation in the Sensitive Fern, Onoclea sensibilis.—Referring to some specimens on the table presented by Mr. Martindale, Mr. MEEHAN remarked that it was the variety *O. s. obtusilobata* of Gray's Manual, and afforded morphologists a rare and excellent opportunity to study the transitional stages by which the male became the fertile frond.

The resignation of Mr. Geo. W. Tryon, Jr., as Curator, was read and accepted, and the following minute ordered to be recorded :—

The Academy, in accepting the resignation of Mr. Tryon as Curator, desires to express its gratitude for the services he has long and faithfully rendered, and its sincere regret that he is unable to continue his official relations in the position which he has so efficiently filled.

JULY 25.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

The following papers were presented for publication :—

"Report on the Hydroids collected on the Coast of Alaska and the Aleutian Islands by Wm. H. Dall, U.S. Coast Survey and party, from 1871 to 1874 inclusive." By S. F. Clarke. With an Introduction by W. H. Dall.

"Description of a Collection of Fossils made by Dr. Raimondi in Peru." By Wm. M. Gabb.

"The Rocks known as Mexican Onyx." By Mariano Barcena.

Supernumerary Anterior Extremity in a Brahmin Bull.—Dr. ALLEN presented drawings of a supernumerary anterior extremity in a Brahmin bull recently on exhibition in Philadelphia.

The deformation consists of a limb exserted from the body at the left shoulder. The extremity is apparently complete, possessing the shoulder, leg, and remaining portions of the limb.

The foot presents its palmar aspect forwards, and bears three distinct digits. The hoof upon each digit is long, compressed laterally, and slightly curved from before backwards. The central digit is the broadest, is slightly longer than either of the

others, and presents a shallow groove upon its convex surface at its base.

Fig. 1.

Fig. 2.

At the surface answering to posterior aspect of carpus of a normal foot (but here in front) are two symmetrical corneous embossements, which may be compared to "cleets." The position of the limb, with its palmar face directed forwards, may be due to erratic rotation of the parts in embryo. Dissection would be essential to determine this point.

On a New Genus of Camelidæ.—Prof. COPE remarked that the dental formula of *Procamelus* is I. $\frac{1}{3}$; C. $\frac{1}{1}$; Pm. $\frac{4}{4}$; M. $\frac{3}{3}$. The number of teeth of the superior series anterior to the true molars being left uncertain by Dr. Leidy, he, Prof. Cope, was able to complete our knowledge of it after an examination of Colorado specimens. He ascribed three superior incisors to this genus at that time, as they are possessed by the species which he named *Procamelus heterodontus*. Having obtained in New Mexico the nearly entire cranium of the *P. occidentalis*, he found that the single lateral incisor in the existing *Camelidæ* is the only one that can be properly assigned to this genus. In this specimen, it is true, a small alveolus on one side contains a small crown of a second incisor; but on the opposite side the corresponding one is shallow and empty. As the last molar it not fully protruded, it would appear that this incisor is a temporary tooth, being shed before the maturity of the animal. It thus differs from the existing camels only in the longer persistence of these transitory incisors. The

position of the first incisor in the specimen in question is marked by a roughness of the surface which indicates the still earlier shedding of a tooth, and filling up of the alveolus. In the *P. heterodontus*, of which the superior dentition of an adult was in his possession, the alveoli of the three superior incisors are large and deep, showing that the dental formula is, I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{4}{4}$; M. $\frac{4}{4}$. The alveoli are empty in the specimen, but this is doubtless due to their regular funnel shape, which gives little hold for the conic, though elongate fangs. This animal, then, represents a genus distinct from *Procamelus*, defined by the dental formula just given, for which he proposed the name of *Protolabis*. The typical and only known species is *Protolabis heterodontus*, Cope, from the Loup Fork beds of Northeast Colorado.

A new species of *Procamelus* was described under the name of

Procamelus fissidens, Cope? *P. occidentalis*, "Leidy."
Cope, Annual Report U. S. Geol. Survey Territories, 1873, p. 531.

This species is distinguished by the shortening of the series of true molar teeth as compared with the premolars, for while the second, third, and fourth premolars are similar in dimensions to those of the *P. occidentalis*, the true molars are considerably smaller. The crowns of the latter are stout, and not narrowed nor furnished with an antero-external ridge as in *P. angustidens*, and the anterior external crescent projects free posteriorly an oblique angular rib on the external face of the crown, being separated from the second crescent by a deep fissure. The last inferior molar is not very elongate, and the fifth lobe a crescentic section, *i. e.*, is concave on the external face, as in the *P. angustidens*.

The inferior border of the ramus is straight from the first true molar posteriorly. The anterior face of the coronoid process is oblique outwards. The edge of the masseteric insertion forms a low ridge concentric with the convex posterior border of the jaw; like the inner face of the same portion of the jaw, the surface is flat.

Measurements.

M.	P. fissidens.	P. occidentalis.
Length of entire molar series	.112	.126
Length of premolars	.0385	.042
" second true molar	.023	.0275
Width of " "	.015	.0165
Length of third "	.033	.036
Width of " "	.014	.014
Depth of ramus at first true molar	.035	
" at middle of last molar	.040	.051
" at apex of coronoid process	.140	
" at condyle	.108	.118
" at post condylar angle	.069	.085

One ramus nearly entire, and the molars of the other (excepting the last) were obtained near the Pawnee Buttes of N. E. Colorado.

The evolution of the existing types of Camelidæ is a good illustration of the operation of the laws of acceleration and retardation. In evidence of this we may follow the growth of the foot and dentition of the most specialized, and therefore the terminal genus of the series, the American *Auchenia*. It is well known that the animals of this genus, in common with other ruminants, have the constituent metapodials of the cannon bone distinct during a longer or shorter portion of fœtal life. As these elements are permanently distinct in the oldest or Miocene genus *Poëbrotherium*, it is evident that acceleration of the process of ossification has caused their union at successively early periods in the genera of later ages. This is indicated by the long duration of their separation in the Loup Fork genus *Procamelus*. It is also well known since the time of Goodsir, that the embryos of ruminants exhibit a series of superior incisor teeth, which disappear early. It is probable, but not certain, that in the Miocene genus *Poëbrotherium*, as in various contemporary selenodont *Artiodactyla*, that the superior incisors persisted. He had, however, discovered that these teeth persisted in the Loup Fork genus *Protolabis* during adult life. He had also found that one, the second of these teeth in *Procamelus occidentalis*, persisted without being protruded from the alveolus until nearly adult age. In genera (*e. g.*, the bunodont *Artiodactyla*) where the incisors are normally developed, they appear at about the same time with the other teeth, and continue to develop to functional completeness. This development is retarded in *Protolabis*, since they are not so matured as to remain fixed throughout life in their alveoli. In *Procamelus* the retardation is still greater, since the first incisor reaches very small dimensions, and is, with its alveolus, early removed, while the second incisor only grows large enough and for a sufficient time to occupy a shallow alveolus, without extending beyond it. In the first incisor the process of retardation has reached its necessary termination, *i. e.*, atrophy[1] or extinction; while in the existing *Camelidæ* the second incisor also has disappeared in the same way. In ruminants other than *Camelidæ*, the third or external incisor has undergone the same process; while, in the *Bovidæ*, the canines also have been retarded in development, down to atrophy.

In the genus *Auchenia*, as has been pointed out, the premolar teeth are two in number; in *Poëbrotherium* of the lower Miocene, they number four, the first and second of the normal mammalian series being present. The first premolar is present in *Poëbrotherium*, *Protolabis*, *Procamelus*, *Pliauchenia*, and *Camelus;* it is

[1] See Proceedings Academy, Philadelphia, 1876, p. 17, for an explanation of these terms.

wanting in *Auchenia* and other *Ruminantia*. In the latter it is present in the fœtus, but soon disappears; in *Auchenia*, according to Owen, it is retained for a somewhat longer time.[1] Thus retardation of the growth of this tooth is first seen in the latter genus so far as known, and is more pronounced in the other *Ruminantia*. The second premolar is present in *Poëbrotherium*, *Protolabis*, and *Procamelus;* it is absent in *Pliauchenia*, *Camelus*, and *Auchenia*. In the last two genera it is a transitional character of immaturity, and we may infer that this is also the case with *Pliauchenia*. It is thus evident that retardation in the supply of nutritive material to this tooth has caused its reduced size, and terminated the duration of its existence. This has not occurred in the other lines of *Ruminantia*, where it remains as in *Poëbrotherium*. From these and many analogous cases, the general law may be deduced, that *identical modifications of structure, constituting evolution of types, have supervened on distinct lines of descent.*

E. O. Thompson and A. E. Foote, M.D., were elected members.

Dom Pedro II., Emperor of Brazil; Capt. Luiz de Saldanha da Gama, of the Brazilian Navy, and Dr. José de Saldanha da Gama, of Rio Janeiro, Brazil, were elected correspondents.

The following paper was ordered to be published:—

[1] Odontography, p. 530.

DESCRIPTION OF A NEW SPECIES OF ÆGIALE AND NOTES ON SOME OTHER SPECIES OF NORTH AMERICAN LEPIDOPTERA.

BY HERMAN STRECKER.

Ægiale Cofaqui, nov. sp.

♀. 2⅛ inches in expanse. Head dark brown; palpi whitish; thorax brown, mixed with hoary, posterior half, above, clothed with yellowish hair; abdomen brown; antennæ black above, white beneath, terminations black.

Upper surface of wings blackish-brown. Primaries with an exceedingly irregular, bright, deep yellow band, extending from vein 1 to the subcostal nervure; the outer edge of this band is rather regular from veins 1 to 4, though further removed from the exterior margin at the latter than at the former; from veins 1 to 2 it is narrow, from veins 2 to 4 it is nearly three times as broad extending to where vein 3 joins the median vein, the balance of it is within the discoidal cell and is narrow, of about the same width as it is between veins 1 and 2; the portion of this nearest the costa is paler in color than the rest. Between veins 4 and 6, exterior to this band, is a mark composed of two small almost connected yellow spots. Interior to these, between veins 6 and 9, is a narrow yellowish-white mark. Midway between the inner edge of the large yellow band and the base of wing, and between veins 1 and 2, nearest to the latter, is a roundish yellow spot. Inner half of base covered with rich yellow hair. Fringe yellowish-white, alternated with dark brown at terminations of veins.

Secondaries. Basal third, especially in inner part, heavily clothed with rich yellow hair and scales. A band of four yellow spots, separated only by the veins, cross the wing beyond the middle; from this band towards the costa, opposite the apex, is another quite small yellow spot, which is succeeded by a larger one near to the costa, nearly midway between the apex and base of wing. Outer margin between the veins yellow, forming patches more or less triangular, with the points inwards. Fringe yellowish-white.

Under surface. Primaries brown, not as dark as above, and shaded at outer margin and apex with hoary; no yellow at base of wings. Markings as above, excepting that the yellow band is

continued from its lower end to, and connected with, the yellow spot between it and the base, and between veins 1 and 2.

Secondaries. Hoary or whitish-gray, dark-brown along costa, especially towards the base. Towards anal angle, a pure white spot, corresponding in position with the first of the series of four that compose the yellow band of upper side; each of the remaining yellow spots of upper surface, and the next one of the two, between them and the costa, is represented by a small dark-brown spot, or rather row of continuous spots; the last towards costa is replaced by one of pure white; half way between this latter spot and the base is another white spot, and also one in discoidal cell, from which a dark-brown line extends to near abdominal margin. Fringes white and brown.

In markings of upper surface, this species resembles somewhat closely the lowermost of Boisduval's figures on plate 70, in the Lep. Am. Sept., but the outline of the wings is entirely different. In the present species the primaries are much produced at veins 2 and 3, and from veins 3 to 7 they are hollowed, making the wing most decidedly falcate, though the apex is very slightly rounded. The inferiors are narrow, even between the apex and abdominal angle, and the wing at the former is not rounded, but the costa and exterior margins meet at almost a right angle. As far as outline goes this species has no possible resemblance to Boisduval's figures, or to the species he purports to represent, the history of which has been given in full detail by Prof. Riley, in Trans. St. Louis Acad. Sc. That species, *Æ. yuccæ*, has much longer and comparatively narrower fore wings, and the shape of exterior margin of these is just the reverse of the present described species, the hind wings are also as entirely different in shape as can be in two insects generically the same. The under surface of inferiors in *yuccæ* is brown, broadly bordered with whitish-gray, especially at the costa, and with a large triangular white spot below costal vein about one-third the distance (from base), between base and apex. The present species has under surface of secondaries grayish, with dark-brown costa, and four conspicuous white spots on various parts of the wing. Boisduval's lower figure may have been intended to represent this insect, but his upper two figures show the upper and under surface of *yuccæ*, though none are correct as regards shape of wings, especially of the inferiors. All three figures on his plate were either drawn from three different examples, or the

artist was most culpably careless, as none are of same size, or agree in outline, though the presumption would naturally be, that the middle figure with wings erect, was intended to represent the under surface of one of the others. What leads me further to suppose that two species are figured on Boisduval's plate, is that the lowermost figure has the small spot on inner half of primaries, of which Prof. Riley says, that of the ten specimens of *yuccæ* he had examined, "none of them have the spot on primaries, indicated in one of Boisduval's figures, just within the middle of the wing and below vein 2."

I have placed this insect in Ægiale, where, with *yuccæ*, I think it belongs; Scudder's *Megathymus* I consider but a synonym of Felder's genus.

The example from which the foregoing description was made was captured in Georgia.

Papilio Indra, Reakirt. ♀.[1]

Same size as ♂. Primaries somewhat falcate, broader and less produced apically. Secondaries more rounded exteriorly; the rudimentary tail even less conspicuous than in the other sex; macular bands on all wings nearly twice the breadth, on secondaries covering part of the discoidal cell. The discal bar of primaries better defined, and at two lines distance inwardly succeeded by another parallel bar, which on the under surface is widened into an ovate spot. In other particulars same as ♂.

Two ♀ examples taken by Mr. Duncan Putnam, July 1st, 1872, in Clear Creek Cañon, between Golden City and the Forks of the Creek, Colorado.

The example above described, through the courtesy of Mr. Putnam, has passed into my keeping, the other, which is still in that gentlemen's collection, differs mainly in the mesial band of secondaries being entirely exterior to the discoidal cell.

These are the only females that I have yet heard of, and no males were seen by Mr. Putnam, nor have any been taken, to my knowledge, since the original types, captured by Mr. Ridings in 1864, on Pike's Peak, Colorado.

[1] ♂ described in Proc. Ent. Soc., Phil. VI. p. 123 (1866), and figured by myself in T. II. Lep. Rhop. et Het.

Cossus nanus, nov. sp.

Expands 1⅛ inches. Has the appearance of a miniature *Cossus ligniperda*, is gray, of lighter and darker shades, and reticulated with black lines which are most noticeable across the disk and on the terminal part of wing. Secondaries uniform grayish. Beneath grayish, faintly reticulated.

Hab. Colorado.

Arctia cervinoides, nov. sp.

Expands ⅞ inch. Head black, white above the eyes. Collar white, with two black bars. Thorax white, with three black bands as in *Nais*, and others. Abdomen black above; at sides and beneath, each segment is broadly edged with white.

Upper surface. Primaries white, marked with black almost exactly as in *Phyllira*, Drury. Secondaries with obscured grayish, ill-defined marks almost semi-diaphanous, resembling those of *Quenselii*, Payk.

Under surface marked as above, but paler on primaries.

Entirely distinct from all known North American species, nearer to *Quenselii*, from Labr., and *Cervini*, Fall., from summit of Alps, than any others I wot of. It is from Colorado.

Cymatophora magnifica, nov. sp.

♂. Expands 1½ inches. Head and collar chestnut-brown; antennæ pectinated and brownish; thorax ashen-white, with a few scattered brown atoms; abdomen brown; legs clothed heavily with whitish-gray hair.

Upper surface. Primaries lustrous brownish-gray or ashen; the outer space, forming a large oval spot extending from apex to inner angle, is brownish-yellow of a somewhat golden tint; this space, as well as the whole upper wing, reminds one strongly of *Phalera Bucephala*, Lin.; on the outer edge of this terminal space, midway between the apex and inner angle, is a parallelogramic brown spot; the inner margin also of this terminal space is edged irregularly with brown marks; the part of the wing adjoining this is paler than the rest; at base of wing is also a pale patch same color as thorax; the whole surface of wing, except the yellow terminal space, is more or less reticulated or flecked with dark brown; none of these reticulations are very conspicuous, except a few which form an abbreviated slight transverse band, which extends neither to costa nor inner margin, and is distant from thorax about

one-third of the length of the wing. Secondaries brown, with paler fringes; they are remarkably produced at the outer angle.

Under surface brown, with indistinct reticulations; the square mark on outer margin, midway between apex and inner angle, is repeated.

Hab. Florida, captured by Mr. J. Doll.

It is doubtful if this is by any means a true Cymatophora, though it undoubtedly belongs to the Cymatophoridæ, HS.; the pectinated antennæ would seem to indicate a position near the insect described as *Dicopis muralis*, Grote, but there is plenty of room for any one who has the inclination to make a new genus for its reception. For my part, I would take infinitely more pleasure in doing away with many of the genera erected of late on trifling grounds, than in adding to the confusion by creating new ones.

Cosmia perophoroides, nov. sp.

Expands 1⅜ inches. Head and thorax pale brownish, insensibly fading into yellowish-white as it nears the abdomen, which latter is also yellowish-white; tarsi dull crimson.

Upper surface. Primaries, same yellowish or tawny-white as in the Bombycid *Perophora Melsheimerii*, which the whole insect superficially resembles in color and ornamentation; the costa, outer and inner margins, edged with a dull crimson line; the whole surface of wing powdered with minute crimson scales; a narrow crimson transverse anterior line, elbowed outwards almost at a right angle in its middle, crosses the wing from costa to inner margin, as also does a transverse posterior line of same color; this latter is rather straight, making but a slight curve a short distance from the costa. Secondaries white, powdered, not heavily, with red at outer margin; fringes white.

Under surface. Primaries, basal third, white, rest reddish, paler towards outer margin, which is edged with a narrow red line, as is also costa and inner margin. Secondaries white, bordered with a few minute red scales on costa and at apex.

Taken in Florida by Mr. J. Doll.

Phrygionis argentistriata, nov. sp.

Expands 1⅜ inches. Much the same silky gray or dove-color as in *P. cultaria*, Geyer, to which it is closely allied; but differs in the gray being a little more inclined to brownish, less bluish, in the inner edge of band that crosses all wings being very much

less silvered, and in veins of hind wings being yellow, narrowly edged with black, from inner edge of this band to past the middle of wing, the yellowish veins being continued or shot off from the yellow of cross band; the sub-basal band of primaries is irregular and strongly elbowed in middle; whilst in *cultaria* it is straight from inner margin to costa. Near the angle produced at middle of exterior margin of secondaries, is a rather large oblong dark red spot, tipped at its outer end with silver; near this, on side towards abdominal margin, is a smaller triangular spot of same color, also with a little silver at outer end; between this and anal angle are two more spots of red and silver, but quite small. The band common to both wings is not nearly so strongly elbowed outwardly in its middle as it is in *cultaria*, and the space between this band and outer edge of secondaries in that, is not nearly so broad as in the species at present described.

Florida, from Mr. J. Doll.

Eudea pænulata, Clemens, Proc. Acad. Nat. Sci. Phila., p. 159 (1860), is the insect lately redescribed under the name of *Parasa incisa* by Dr. Leon Harvey in Can. Ent., p. 5, vol. viii, 1876. His type he received from Belfrage in Texas, who also sent me examples of it, which, as above stated, turned out to be Clemens' species.

AUGUST 1.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

Diurnal Motion in Liatris pycnostachya.—Mr. MEEHAN called attention to a peculiar diurnal motion he had observed in *Liatris pycnostachya.* When throwing up its flower stems the top was always curved over towards the east in the early morning, nearly erect at midday, and towards the west at sundown. For commercial purposes he had thousands of plants growing, and the habit was uniform in all. The motion was evidently vertical, and not in a horizontal direction, and this still left it open to ascertain how the point turned towards the east for its early morning start. As soon as the flower spike approached its full growth the motion ceases.

Fasciated Branches.—In reference to a broadly flattened branch of a sweet potato on the table, to which attention had been directed by a member, Mr. MEEHAN said these branches were found on numerous plants, and there was no reason why all plants may not be found to produce them. They were species of fasciations, which took different forms at times. In trees they often appeared as "crow's nests." The old theory referred them to over-luxuriousness; but in a paper published in the Troy Proceedings of the American Association it was shown to be just the reverse. In union there is strength, in vegetable as in other bodies. Any tendency to a multiplicity of small branches on a tree instead of making a few large ones, all other things being equal, is an evidence of lower vitality. And this was proved by these fasciations. In severe winters fasciated branches were the first to die. Often they were the only branches that were destroyed.

Again, it had been shown in his papers before the American Association and before the Academy of Natural Sciences of Philadelphia, that only when a flowering portion of a plant was in the best conditions to maintain its hold on life, in other words in the highest conditions of vitality, did it produce pistils, or female flowers. With a lowered or depreciated vitality the male organs of the flower or male conditions were favored, and it was a singular fact that whenever these fasciations flowered, the female organs were nearly always abortive, and stamens and petals increased at their expense. These were some of the facts which had proved the old notion that over-luxuriousness, in the sense of high vital power, had nothing to do with fasciations, but rather the reverse.

The final cause of this defective vitality was imperfect nutri-

tion in that immediate part. This was as near to the full explanation as science could get as yet.

The facts were not as new as he liked to bring before the Academy, devoted as it is to original research; but the conclusions of the Troy paper are rather recent, and not yet well known, and this might excuse his remarks.

Mineralogical Notes.—Dr. GEORGE A. KŒNIG spoke about the coloring matter of the *amazon stone* from Pike's Peak. This beautiful mineral has lately been obtained in large specimens and in considerable quantity through the exertions of Dr. Foote, who furnished the author with the material for this investigation. The color of the amazon stone from Pike's Peak varies between a light bluish-green and a dark emerald-green. On many specimens the faces of modification, as prisms and domes, are without color, or yellowish, or flesh-colored. The interior of very large crystals is likewise of a much lighter color generally than the outside.

Assuming the coloring principle to be a compound of iron, the following experiments were made to test the value of this hypothesis:—

1. Fragments were exposed to the action of boiling hydrochloric acid and aqua regia for several days, until the liquid was free from iron. Under this treatment the intensity of color was increased, the coloring substance withstands, therefore, the action of the above agents.

2. Fragments, prepared by the treatment described, were placed in a glass tube, and hydrogen passed through the latter at a red heat. After cooling, the mineral was found possessed of an evenly spread *gray color*.

3. The same pieces were now treated with oxygen at a red heat, and exhibited, after cooling, an even *rose* color, the intensity of which was proportional to the intensity of the green.

4. Green fragments were heated in an atmosphere of dry chlorine, at increasing temperatures. No change occurred until at a red heat, when the mineral became perfectly white, and a slight sublimation of ferric chloride was noticed.

5. The rose-colored pieces become white when boiled in strong hydrochloric acid.

6. Thin fragments do not show at any place a concentration of the green color, when examined under the microscope.

7. Heated in the outer flame of a Bunsen burner, the same effect is caused as in the current of oxygen, but with a less brilliant color.

These experiments prove—

First. That the basis of the coloring substance is *iron*.

Second. That the iron is present as a very stable compound, probably as an organic salt.

Third. That the coloring substance is not in molecular combination with the feldspar; because, if it were so, the iron could

not be extracted completely by hydrochloric acid from a solid piece after oxidation; but that the color is of later date, and caused by infiltration into the numberless capillary cleavage fissures of the mineral.

Investigation into the composition of the organic acid is reserved for a future communication.

Dr. KŒNIG also mentioned his discovery of *Zircon* in the amazon stone from Pike's Peak. Dr. Foote had observed brownish spots in the feldspar, with an apparent cleavage. The speaker was able to extract complete crystals, showing a tetragonal habitus: $P + \infty P \infty$. The largest crystal measures $\frac{1}{4}$ inch in length by $\frac{1}{8}$ inch square. The angle of the pyramidal faces was found 122°, which is near the zircon angle. The prismatic faces are uneven by the preponderance of a step-like structure; there is a prismatic cleavage. Lustre, greasy vitreous; color, dark grayish-brown; fracture, straight. H = 6.5, spec. gr. = 4.065. Every crystal is associated with columbite in well-defined prismatic needles, which pierce the zircon. The powder has a cinnamon color. Owing to the deficiency of material, only an approximate analysis can be given for the present.

SiO_2	= 28.00
MgO	= 8.93
$(Fe_2O_3)ZrO_2$	= 60.00
H_2O	= 3.47
	100.40

Besides the large percentage of magnesia, there is a very anomalous behavior in the zirconia. It is easily soluble in oxalic acid, and the oxalate dissolves in a very small quantity of water, and is not decomposed by boiling in a dilute solution. He had since established the same behavior in the earth from the Clay County, N. C., zircons, and was still engaged in the study of this matter.

Dr. KŒNIG mentioned further the occurrence of *earthy barite* on the calcite from the city quarries of St. Louis, Mo.

This mineral is found in very friable clusters between the large crystals of calcite. Color perfectly white. Under the microscope the powder resolves into transparent prismatic crystals. They are small enough to pass through the meshes of a hair sieve.

The analysis gave—

$BaSO_4$	= 98.8
Fe_2O_3	= 0.5
Ignition	= 0.14
	99.44

This is one of the purest varieties of barite on record.

On Frost-Drift in North Carolina.— Prof. W. C. KERR remarked that there are some peculiar features in the surface geology of North Carolina which have not hitherto been accounted for. We have no true glacial drift, or at least none well characterized. But besides the ordinary quaternary gravels which overlie a large section of the coastward half of the State, there are found, chiefly on the flanks and among the foothills of the Blue Ridge, and over a considerable portion of the Piedmont region, beds of earth and stones which are characterized by a peculiar arrangement of their materials, explicable neither on the theory of their being morainal nor modified drift. Reference was made to the subject in the North Carolina Report of last year, and a theory suggested; but as illustrations were wanting, it was not practicable to do more, and he should require the blackboard now to make the matter intelligible. He represented, in a diagram, the succession of different arrangements of the detrital materials as they may be seen in descending the slopes on which these accumulations are found. All our gold gravels come under this description of quaternary deposit. In one part of the diagram the arrangement which obtains in the higher portions of the deposits, nearest the source of the materials, was represented. The lower part, perhaps one-half or one-third of the vertical depth, is filled with angular and little worn fragments of quartz and other hard rocks; the upper part being simply unstratified earth. As we descend the slope, the angular blocks have become more rounded, and are accumulated in a successively lower and more crowded stratum, at last hugging closely the surface of the underlying rock. In the case of the auriferous gravels, the gold is found, of course, only on the upper slopes, and near the sources of the materials, its greater specific gravity insuring its speedy descent to the bottom of the moving mass. It is perfectly obvious, both from the position of these beds on the slopes of hills and mountains, up to 1500 feet above the sea, and from their arrangement, that they have not been deposited under water. And it is equally evident that they are not true glacial drift; and, indeed, they are readily traced, in many cases, to their sources, distant only a few rods, or even feet. But he had not hit upon the solution of the question of the origin and mode of accumulation of these beds until he had accidentally found in a railroad cut near Morganton, the structure indicated in the second diagram, where a small quartz vein was represented rising up, undisturbed, through the underlying strata of rock, in a nearly vertical direction, until it reaches the lower surface of the deposit in question, where it is seen to be suddenly interrupted, and its materials—angular fragments—strewn along the surface of the rock, down the slope a distance of several yards. A close study of this phenomenon at last suggested the theory which he had proposed of *frost drift*. It is obvious that in subglacial regions (and in glacial regions in subglacial times) the annual frosts of winter would penetrate to a

great depth; and likewise the summer thaws, aided by the enormous precipitation which characterized those regions and times. And it is equally obvious that a mass of water-saturated earth, in freezing and thawing, must be subject to the same laws of movement as a true glacier, the rate of motion being proportioned to the quantity of water. The depth of some of these deposits at first presented a difficulty, this depth rising in some cases to twenty and even thirty feet, although they are for the most part less than half that depth. But after learning that in Vermont, in the winter of 1874–5, the frost penetrated to a depth of eight feet, and that in Siberia and other subarctic regions the ground is annually frozen and thawed to a much greater depth, there seemed to remain no part of the phenomena presented by these beds which is not satisfactorily accounted for by the theory.

The occasion of his bringing this subject to the attention of the Academy was this: In passing an excavation on Market Street, above Forty-Fourth Street, he had observed a new and striking confirmation of the view just presented. In an accumulation quite like those already described as occurring in North Carolina, this additional feature was observed: several banded seams of decomposed mica schist, standing nearly vertical in the undisturbed rock below, on reaching the lower edge of the drift were bent at a sharp angle, in the direction of the movement of the mass, down the slope, and were traceable many feet, diminishing with a gradual and regular taper in a horizontal direction, until lost in the homogeneous mass of earth which formed the body of the bed. How this happened is obvious enough on the theory given, but on no other known to him.

AUGUST 8.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

On the Diurnal Opening of Flowers.—Mr. THOS. MEEHAN referred to observations he had made this season on the nocturnal and diurnal expansion of flowers, and said that, contrary to the popular impression, it was not probable that light or its absence alone determined the opening of the blossoms. There were some plants, as, for instance, *Œnothera biennis*, the evening Primrose; *Anagallis arvensis*, the "Pimpernel," and others, which remained open or otherwise longer when the weather was humid or cloudy, and were looked on in consequence as kinds of floral barometers; but from other facts it was clear that it was not the weather merely, but some other incident accompanying the weather that governed the case.

For instance, though *Œnothera biennis*, and other Œnotheras,

opened at evening, and, if the atmosphere be moist, continue open the greater part of next day, many species opened only in the daytime; and this they did regularly, quite regardless of meteorological conditions. *Œ. serrata* of Colorado was one of these. It was regular in opening about noon; the blossoms were all closed long before sundown.

In other allied families we saw similar divergence. In the Cactus family, *Opuntia* and *Mammillaria* opened only about midday; while most of the *Cereus* opened at night. The night-blooming Cactus was a familiar example. But the chief interest was in the fact that many had their special hours of day or night for the expansion. The *Portulaca oleracea*, common Purslane, opened about eight A. M., and by nine had performed all its functions; while a closely allied plant, the *Talinum teretifolium*, from the serpentine rocks of Chester County, opened at one P. M., and was closed by three. The conditions of the weather did not seem to influence them.

There was the same attention to daily periods in the growth of the parts of plants, as well as in the expansion of the petals. In composite plants the floral growth was generally in the morning, and was usually all over by nine or ten o'clock A. M. The elongation and expansion of the corolla was usually completed in an hour after sunrise, but the stamens grew for an hour more, and the pistil continued for still another. There was little if any growth in the floral parts after nine o'clock in a very large portion of this order of plants.

In grasses, *Cyperaceæ*, and some rushes also, the floral parts were very exact in their time of opening. In the plantains (*Plantago*) the pistils appeared a day or more in advance of the stamens; and these last appeared at about a regular time in each day. In *Luzula campestris*, the wood rush, he had by a series of observations timed it exactly. Before nine the anthers were perfect, but by ten the pollen has been all committed to the winds, and only dried membranous matter remained. So far as he could ascertain, meteorological conditions did not influence the time in the least in this case.

The popular impression of light and moisture as agents in this behavior, had seemed to receive a tacit scientific assent. It was clear, he thought, there was a more powerful agency underlying these; and it was, perhaps, a gain to science to be able to see this, though in so dim a light.

Dr. Henry C. Chapman was elected curator in the place of Mr. Tryon, resigned.

AUGUST 15.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

On Hexagonite, a New Mineral.—Mr. E. GOLDSMITH remarked that Mr. John C. Trautwine, of Philadelphia, had been kind enough to present to him a mineral from near Edwards, St. Lawrence County, N. Y. As it was not comparable with any of the known species that occur in said locality, it was presumed by Mr. T. to be new.

The mineral is crystallized hexagonally, the forms noticed being the infinite pyramid (110), and the basal plane (111). The crystals are small, from about 3 mm. in length and 1 mm. in thickness, although some are 5 mm. thick. Two distinct cleavage planes were observed, which could be easily produced by striking the specimen with the hammer. It was found that these planes intersected at 120°; there is a third cleavage plane parallel to (111), but less smooth than the former.

Fracture uneven. The small crystals and fragments are transparent, while the thicker ones are semi-transparent.

Lustre subvitreous, somewhat glimmering on the cleavage (110); on the basal plane the lustre is dull.

A basal cleavage fragment was introduced between two Nicol prisms transmitting no light, in such a way that its principal axis formed a continuous line with that of the prism, and, no change in the light being observed, the crystal was pronounced uniaxial. The color is pale violet, but not equally distributed; the mineral in spots is colorless, and it is thought that if the substance was absolutely pure it would have no color. The coloring principle, which is a small quantity of manganese, is so finely distributed through the mass that it is impossible to separate it mechanically.

The streak is colorless, and so is a large bulk of the powder.

The substance is brittle.

Its hardness is between apatite and orthoclase; that is, 5.5. S.G = 3.011.

If the substance, in the form of a thin splinter, is heated to redness in the Bunsen burner flame, no change is produced; the same is the case if the oxidizing flame with the blowpipe is directed upon it; but a rounding of the sharp edge of the splinter is effected by treating it in the reducing flame; the transparent substance then becomes opaque and white, enamel-like. On moistening this rounded spot with cobalt solution, and strongly reheating, a violet coloration is produced. In the glass tube there

is no change whatever. The flame reaction indicates the presence of soda.

From the above observation he pronounced the mineral to be infusible.

Fused with microcosmic salt, it shows a skeleton of silica; and if heated with borax in the oxidizing flame, the reaction of manganese is observed; the same if heated with carbonate of soda in the oxidizing flame.

On coal heated with cobalt solution a violet mass is produced, which is due to the presence of a small quantity of alumina and a larger of magnesia.

In regard to its solubility in acids, it was observed that it yielded only to hydrofluoric acid, the others having no effect. The fine powder was fused with carb. soda, in order to find all the elements contained in it by the processes in qualitative chemical analysis in the wet way; by this means were found silica, alumina, and manganese, lime and magnesia.

The quantitative analysis gave these results:—

Silica . . .	57.92	per ct.	contains	oxygen	27.91	
Alumina and manganese	2.39	"				
Lime . . .	11.98	"	"	"	3.42	= 14.45
Magnesia . .	26.23	"	"	"	10.49	
Soda . . .	2.10	"	"	"	0.54	
	100.62					

The alumina and manganese amounting to 2.39 per cent. are considered as an impurity, and for this reason they are excluded from the consideration of the ratio. The oxygen ratio of the bases and the silica is as $14.45 : 27.91 = 1 : 1.9$, or adopting 2 for the latter will give the general expression $(\dot{R})_4\ddot{S}$, in which $(\dot{R})$ stands for the monoxyds ($\dot{C}a, \dot{M}g, \dot{N}a$). The new mineral species hexagonite is formulated thus: $(\dot{C}a, \dot{M}g, \dot{N}a)\ddot{S}i_2$.

As this described bisilicate is anhydrous, and is crystallized in hexagonal form, it consequently belongs to the beryl group, of which it will be the third species.

On Opuntia Rafinesquii and O. vulgaris.—Mr. MARTINDALE remarked that the large natural order of plants, the *Cactaceæ*, comprises about 800 species chiefly natives of tropical countries, and the western part of the United States, where many grow to an immense size. The only representative of this large order in the northern United States, east of the Mississippi, is the genus *Opuntia*. The only species of that genus described in the older works on the flora of that section, is the so-called *O. vulgaris*, "from Massachusetts, southward, mostly near the coast." In the new edition of Gray's Manual, the *O. Missouriensis*, a western species having dry prickly fruit, is admitted as occurring in Wis-

consin, and *O. Rafinesquii*, with smooth pulpy fruit, somewhat like the *O. vulgaris*, also in the western section from Wisconsin to Kentucky. Dr. George Engelmann, of St. Louis, in a recent examination of the genus, after comparing specimens from Massachusetts, New York, Pennsylvania, and New Jersey, heretofore classed as *O. vulgaris*, determines them to be identical with *O. Rafenesquii* from the west. In a recent note from him he says, "I have specimens growing here from Massachusetts, New York, Pennsylvania, and New Jersey, and they are all *O. Rafinesquii;* the *vulgaris* I have only from the falls of the Potomac and South Carolina."

In June last Mr. Martindale collected near Haddonfield, N. J., some specimens of *Opuntia* in flower, which on examination, and comparison with the species as figured in the fourth volume of the Pacific Railroad Reports, he had determined to be the *O. vulgaris*. In the latter part of July he again examined the plant, then in full fruit, and his former conclusion was sustained. He also sent a fully developed specimen to Dr. Engelmann, who pronounced it to be the true *O. vulgaris*, which he had not before seen north of the falls of the Potomac, and asked if it is a real native in New Jersey. On that point he thought there could be no doubt, as the owner of the land, John Gill, informed him it had been there to his knowledge at least twenty-five years; and while it does not incline to spread any, shows no signs of disappearing.

On comparing this plant with specimens growing near the coast, and which appears to be the *O. Rafinesquii*, the following characters appear. The *O. vulgaris* has a pale green appearance, the flat joints obovate, with small ovate subulate leaves, stout and tapering from a broadish base, mostly less than one-fourth of an inch in length, and appressed to the joint, with a fascicle of minutely barbed bristles, and occasionally a spine in their axils. The flowers are sulphur-yellow; the fruit smoothish, about an inch in length, and half an inch in thickness, somewhat ventricose, or largest just above the middle, and tapering to the base, with a depression at the top where the flower had fallen off, from one-eighth to one-quarter of an inch in depth. The *O. Rafinesquii* has rather larger flowers, occasionally with a reddish centre; more numerous petals; the fruit fully one and a half inches in length, with an elongated tapering base; the depression in the top of the specimens examined is rather shallower than in the *vulgaris;* the older joints have a darker green appearance, the leaves more slender, longer, from one-quarter to three-eighths of an inch in length, and spreading, and more frequently with the large spine, particularly about the top of the joint.

He had examined specimens from Woodbury, New Jersey, about twelve miles from the Haddonfield locality, which are *O. Rafinesquii*, and which have fusiform tubers on the extremities of the roots, similar in this respect to a western form of *Rafinesquii* described in the Pacific Railroad Reports as *O. fusiformis*. He

had not been able to find tubers on the vulgaris, and the published description of that species made no mention of any.

There is growing in the Meehan nurseries, near Germantown, Pa., a specimen of *O. Rafinesquii* from New Jersey, which is identical with one from Illinois, also a specimen of *O. vulgaris*, from Harper's Ferry, Virginia, which is identical with the one collected near Haddonfield, N. J. These two species are somewhat closely allied; yet the form and position of the leaves are manifestly different, and being early deciduous is possibly the cause of their being so long confounded. Certain it is, if the two species as described are distinct, we have both of them in New Jersey.

Supernumerary Anterior Extremity in a Domestic Cow.—Dr. ALLEN exhibited a drawing of a malformation somewhat similar to that recorded in the Proceedings of July 25.

In this instance, however, the digits were reduced to two. These were of unequal size and one only was terminal. The remaining digit was appended to the side of the metacarpus, but was not articulated with it. It was indeed a dwarfed digit held in position to the metacarpus by fibrous tissue and integument. When at rest it lay nearly parallel to the main digit. Each digit possessed a well-developed hoof-like covering, the larger mass being curved and compressed from side to side, while the smaller one was styliform.

Above the smaller digit was a small conical appendage, which may be considered a localized hypertrophy in the normal position of the "cleet."

AUGUST 22.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty members present.

AUGUST 29.

The President, Dr. RUSCHENBERGER, in the chair.

Twelve members present.

A paper entitled "Note on the Discovery of Representatives of Two Orders of Fossils new to the Cretaceous Formation of North America," by Wm. M. Gabb, was presented for publication.

On the Coal and Iron Resources of Alabama.—Mr. WILLIAM GESNER remarked that a number of applied and interesting

scientific facts had developed themselves in connection with the construction of geological sections in miniature of the Warrior and Cahaba Coal Measures in Alabama for exhibition at the Centennial. The frequent inquiry for information concerning them had induced him to believe that a description of these measures would prove interesting to the Academy of Natural Sciences.

The three coal fields of Alabama, comprising an area exceeding seven thousand square miles, and separated by narrow silurian valleys, are just now being brought into prominent notice by the superior character of the coals and coke they afford, and the economy incidental to the manufacture of iron by their means.

The valleys which separate these fields being stored with inexhaustible supplies of the best grades of hematite and brown ores, even to that variety best adapted to the manufacture of ferromanganese, it seems surprising that both of these resources should have been allowed to lie dormant for such a length of time, while others of less extent, richness, and economy of working have been given their fullest development.

It is now ascertained that the coal measures of the Warrior and Cahaba coal fields consist severally of 172 and 173 strata, embracing respectively forty-six and fifty-one coal-seams of all dimensions, from one inch up to six feet six inches in thickness, constituting a grand aggregate of one hundred and eighty-eight feet of bituminous coal.

In the Warrior field there are many localities where the beds of coal lie horizontally, while in the Cahaba they are more frequently inclined; but all of those being worked in either are reached by slope or tunnel.

Two beds of black band characterize the Warrior measures, one of them showing a richness of 43 per cent. metallic iron; clay iron-stone is abundant, and is found in all of the coal fields in Alabama. In one instance it constitutes the roof of a twenty-eight-inch bed of coal in the Warrior measures.

The fossil fauna and flora of these beds are found to be similar. Immediately beneath the mountain limestone of the carboniferous formation in the upper silurian, a bed of fossiliferous hematite occurs as one of its members. It extends in a northeastern direction, a distance exceeding 120 miles, and into the State of Tennessee, where it may be seen outcropping, interstratified with ferruginous limestone seven feet thick, under Mitchell's Point, Walden's Ridge.

In Jefferson County, Alabama, its thickness is found to be twenty-eight feet, gradually becoming thinner toward its northeastern prolongation. Wherever it outcrops on the top, from the sides, and in the valleys of Red Mountain, it is noted for affording the most fertile soils.

It is conceded by all who see and examine this immense bed

of ore, that it is to become the great base from whence in the future our principal supplies of iron will be produced.

In the neighborhood of from two to three miles east and west of this ore bed lie the coal fields before mentioned. For its entire extent through the State, and immediately under it, lie the limestones of the silurian formation, among which are many of the purest and those best adapted for fluxing iron from its ores.

Geologically, in descending order, next occur the immense beds of brown ore, comprising the varieties manganiferous and fibrous limonite, mamillary and crystallized hematite, belonging to Talladega, Coosa, Cahaba, Roop's and Murphy's valleys, from which heretofore nearly all of the Alabama iron has been produced—charcoal being used for fuel.

At the present time, by a practical application of all of these advantages, great progress has been made by the Eureka Company, under the able superintendence of Mr. James Thomas.

After remodelling the plant of the former Red Mountain Iron and Coal Company at Oxmoor Station, on the South and North Alabama R. R., he has put in hot blast one furnace, on coke produced on the spot by ovens, with attached combustion chambers of his own devising. The ore charges are made to consist of the mixture—three-quarters fossiliferous hematite and one-quarter brown ore, which is yielding from the furnace 56 per cent. good pig metal, costing under twelve dollars per ton in its manufacture. In view of these facts it becomes evident that Alabama will soon attain pre-eminence in the production of iron; and, as steel supersedes its use for railroad and all other mechanical appliances (our next great stride in the march of civilization), she must become most populous and prosperous, for her climate is equable and her soils rank among the most fertile.

Dr. S. H. Linn, of St. Petersburg, Prof. Paul Groth, of Strasburg, and Dr. James Hector, of New Zealand, were elected correspondents.

The following papers were ordered to be published:—

THE ROCKS KNOWN AS MEXICAN ONYX.

BY MARIANO BÀRCENA.

I have the honor to present before this Academy a report upon the calcareous rocks of Mexico, which so deservingly are occupying the attention of the public in the present International Exhibition.

These rocks are known in Mexico by the names of "Tecalli," "Mexican Onyx," and "Mexican Marble." The first of these names refers to the place where they are found, as the principal beds are located in the neighborhood of the town of Tecalli, in the State of Puebla. The word Tecalli is a compound one, and, in my judgment, is derived from two Aztec words: *Tetl* (mountain) and *Calli* (house), the meaning in this case being "House of the Mountain." The origin of the word might be supposed as well to be *Teocalli* (God's Mansion), name given by the Indians to their temples.

The names Onyx and Mexican Marble are due: the first, to the fact that, like the true onyx, the Mexican rock shows stains and parallel stripes; and the second, to their chemical composition, which, in point of fact, is the same as that of the common marble.

I have read in some of the latest European journals that Mr. D'Amour informed the Academy of Sciences of Paris, that the Mexican onyx was nothing but a *calcareous alabaster*. This same opinion was expressed by myself, more than two years ago, in the "Mexican Society of Natural History." It was published in the first number of the third volume of "La Naturaleza," and I have been most happy to learn that the classification of that celebrated chemist agrees with mine.

The rocks of Tecalli offer a great many varieties in their different grades of transparency, in the diversity of their colors, and in their physical properties. In order to make a close examination of these rocks, I selected a white specimen, as I considered this to be the purer variety. The characteristics were as follows:—

Irregular form. H = 4.90 (Breithaupt's scale), G = 2.90. Lustre vitreous—resinous. Color white, slightly tinged with green. Transparent in thin slices, and translucent in pieces of some thickness. Fracture splitting in the oblique section and fibrous, with a somewhat silky appearance in the vertical section. Streak white.

B. B. infusible, becoming opaque and with a light reddish color. In two analyses made I found the following composition:—

Lime	55.00
Magnesia	1.25
Water and oxide of iron and manganese	0.10
Carbonic acid	42.40
Sulphuric acid	1.25
	100.00

This composition shows that the rocks are essentially formed by carbonate of lime, and that the other substances may be considered as accidentally mixed, because of their existing in different proportions in the red, green, and yellow colors, as observed in the block.

The small proportion of sulphuric acid discovered was probably in combination with the lime, as the quantity of this base exceeded that which is required for combination with 42.40 of carbonic acid; for this proportion of the acid are required 93.96 of lime. The excess of this base is 1.04, which would take 1.48 of sulphuric acid to form the hydrous sulphate (Anhydrite), being this amount of acid very similar to that found in the analysis.

The oxides of iron and manganese, as well as the selenite, were mixed only with the carbonate of lime, which alone formed the bulk of the analyzed specimen.

Prof. W. J. Ward lately presented to the Royal School of Mines in London a qualitative analysis of the same rock, having found exactly the same substances that I did myself on my examinations; but, I understand he selected one of the most colored varieties, as he found the iron in large proportions, and partly combined with the carbonic acid. He found the sulphuric acid, and also the oxides of iron and manganese, which latter he considers to be the only coloring matters.

The capricious variegation of colors produced by those oxides, as well as the different grades of transparency and opacity in the polished slabs, give them that magnificent aspect which constitutes their indescribable beauty. When the blocks are cut in the direction of their planes of stratification, the shades appear in the form of clouds, flames, and stains of all dimensions. The clouds at times appear simulating somewhat the form of *cumuli*, or that of *cirrus*. The combination of those extreme grades, and

of other intermediaries, added to the difference of opacity in some portions of the same slab, produce the most beautiful and inimitable effects. In some we find the figures of mountains, ruins, and several other objects which look very much like landscape sketches. The colors vary from the dark-green to the apple-green, and from the intense red to the lightest rose tint. There are also varieties of yellow and blue which intermingle with the former. The metallic oxides which produce this coloration are found in greater proportions towards the borders of the veins of some of the rocks, and through which was effected the infiltration of the waters which contained the coloring materials.

The rocks of Tecalli admit of a higher polish than the common marble. This can be seen in the many specimens now on exhibition in the Mexican Department of the Main Building, and which, by their brilliant surfaces, colors, and transparency, admirably imitate the agates and the true onyx.

By the foregoing peculiarities we find that the Mexican marble belongs to the group of the *calcite*, and from its physical properties to the variety designated as *Travertine*, under which head is classified the *calcareous alabaster* or *onyxite*.

The good reception of these rocks in the markets, the extent of their deposit, unequalled perhaps in this respect, give them sufficient interest to deserve the names of *Onyx* and *Mexican Marble*, a name which probably will be always adopted in commercial language. The beds of the rock are situated in the neighborhood of the town of Tecalli in the State of Puebla.

In a report which the Mexican Engineer, Mr. Patricio Murphy, made two years ago, he mentioned three principal deposits which bear the names of "La Pedrera," "Tlahualco," and "Aratleta." The most important of these is the first named, located at twenty miles from the city of Puebla. According to Mr. Murphy, the mountain where the Mexican marble is found is alternately formed of beds of this rock, argilleous calcareous rocks, and marls and sands. The quantity in which those rocks are found is very extensive, and warrants the expectation of an almost unlimited supply. It is to be hoped that the use of these rocks will be soon extended, because, as they are far more beautiful than marble, and resemble so much the true onyx and agate, they are appropriate for the richest and most splendid decorations.

ON PHOTOGRAPHS OF TASMANIANS AT THE CENTENNIAL EXPOSITION.

BY CHARLES PICKERING, M.D.

During my visit to Australia, in or about 1840, every one at Sydney spoke of the Australians as a distinct people from the natives of Tasmania or Van Diemen's Land; the Australians, it was said, are "straight-haired blacks," and the Tasmanians are "woolly-haired blacks;" but, not meeting with a Tasmanian, I did not feel authorized to make a distinction on my Map.

Recently, at the Centennial Exposition, photographs of Tasmanians, and especially of the last male survivor, have enabled me to form an opinion, and refer the originals to the *Papuan Race* or large New Guinea negro.

Among the varieties of man, the Papuan is remarkable for his harsh skin; and it is on record in books of travel, that the skin of Tasmanians is not soft to the touch like that of Australians; also, that the Tasmanians fill their hair with mud (a characteristic trait of Papuans).

New Zealand was peopled by Polynesians from the tropics. The emigrants, leaving behind all tropical plants, yet carried along old familiar names, some of which they transferred to the productions of the colder climate; one instance I will quote from memory:—

The *Barringtonia* of the tropics bears a large husky fruit, which is used by the natives to float their seines or nets; the Polynesian name of the tropical tree has been transferred in New Zealand to a tree of the pine kind; its wood, however, is very light, and made by the New Zealanders into seine-floats.

Tasmania in a similar manner was peopled by Papuans from the tropics, by emigrants probably acquainted with agriculture, but who did not bring esculents suitable for cultivation in the cold climate of the new country.

Two other important corrections have come to light since the publication of my Map:—

One is the discovery by Schweinfurth, in Central Africa, of a country under the equator inhabited by the *Hottentot* race, identified by him with the pigmy nation that, according to Homer,

suffered from attacks by cranes; the true location even pointed out by Herodotus.

The third correction is derived from photographs, showing that the Aino of Northern Japan, Yeddo, Saghalien, and the neighboring islands belong to the *White* or Caucasian Race. The most eastern island bears the name of "Yurup," as though given by a land party journeying east in search of Europe, precisely as Columbus by sea journeyed west in search of Asia. The geographical position of the Aino, and their maritime expeditions to the Aleutian Islands, accord with Mexican and South American tradition of an ancient intercourse with long-bearded white men from the west (see Humboldt).

SEPTEMBER 5.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

A paper entitled "Hexagonite, *Goldsmith*, a variety of Tremolite," by Geo. A. Koenig, was presented for publication.

Morphology of the Pear.—Dr. MCGRATH placed on the table abnormal fruit of the pear, in appearance resembling huge acorns. Mr. THOMAS MEEHAN took occasion to note the recent advances of morphological knowledge as explaining such phenomena. Even recent text-books taught that a fruit was but modified leaves. The exact truth is that a fruit is leaves *and branch*. When a bud is being formed in the apple, pear, or similar fruits, it may finally be either a flower-bud or a bud producing a new branch. Varying phases of nutrition decide this question. Exactly the nature of this variation we do not know; but we do know that the growth-force in the bud is arrested by some law of nutrition, and, instead of an elongated branch, what would be its series of spirals are drawn together closely, and the whole modified and made to form a flower. Thus, in the pear, it takes five buds to form one full cycle on a pear branch. When growth is arrested to form a flower this first cycle is transformed into a five-lobed calyx, and generally this becomes much enlarged and fleshy, and covers all the other cycles of buds which go to make up the inner layer of flesh terminating in the petals, carpels or core, and so on. Now, in the case before the Academy, the arresting force was imperfect. It had succeeded in forming the outer or calycine verticillate series of buds into a fleshy matter, giving what here might be called the cup of the "acorn," when the accelerating or branch-producing force gained a temporary advantage and pushed on, forming the acorn-like centre, but only to be soon again arrested. This abnormal pear was indeed nothing more than an effort of the tree to produce a branch after a fruit had been decided on; a struggle which was finally decided in favor of the fruit, if we might speak metaphorically in explaining the case.

Natural Hybrids.—Mr. MEEHAN said that modern naturalists were mostly convinced that new forms were evolved from old ones, but how much the new form had been influenced in its creation by a thus far mysterious law of change inherent in the old form, impelling it to bring forth the new one when nature's own good time had come; or how far external influences acted in bringing about these changes, was still a matter for science to solve. He thought

the innate power of change was much greater than many of our best naturalists were willing to grant. In illustration, he held a letter from a leading botanist inclosing what he contended was a hybrid between *Verbena stricta* and *V. urticæfolia*. Mr. M. described the structure of Verbena. The tube of the corolla was half an inch in length, and narrow, and only insects of a large size and long trunks could reach to the bottom for honey. The anthers were curved just above the stigma, and both organs matured near together. Above all, and completely closing the entrance to the tube, was a dense mass of hair. Supposing, on prevailing theories of cross fertilization by insect agency, that an insect should visit the verbena flower for honey, and the trunk get covered with pollen, the rather large trunk would get stripped clean of its pollen in wiping against the mass of hair on withdrawal; or, if a little did remain in spite of the brushing, would most likely get thoroughly cleaned on the visit to the next flower. Hybridization by this agency, and there appeared to be no other in this case in nature, was well nigh impossible. He had always regarded the dangers of hybridization, and consequent confusion of species, as an *à priori* argument against the prevalent theories of cross fertilization by insect agency being any part of a great plan for the development of the races of plants. At any rate in *Verbena*, the mass of hair in the throat could not by any interpretation be regarded as an arrangement in the aid of cross breeding. It was an obstruction, and, in his opinion, an insurmountable one.

The striking form of Verbena between *V. stricta* and *V. urticæfolia*, sent to him by his distinguished correspondent, he should regard as no hybrid, but as a form evolved in the due course of an inherent guidance from the former species, a power continuously at work, and which "external circumstances" tended as often to repress as to aid.

SEPTEMBER 12.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "On the Lingual Dentition, Jaw and Genitalia of Carelia, Onchidella, and other Pulmonata," by Wm. G. Binney, was presented for publication.

Welwitschia mirabilis.—Mr. THOMAS MEEHAN called attention to a specimen of *Welwitschia mirabilis*, exhibited in the Portuguese African section of the Centennial Exhibition, as well worthy of the examination of members of the Academy. The trunk in this specimen is vase form, and about two feet across, and stands about two feet from the ground.

Nocturnal flowering of Mentzelia ornata.—Mr. THOMAS MEEHAN said this old species had only just found its way into cultivation, and afforded an opportunity to note its distinctive habits. His nephew, Mr. Joseph T. Meehan, had kindly watched for him, and found that the same flower opened on four successive nights; on the fifth it made a weak attempt to open, but soon faded away. The flower commenced to open soon after sundown (6 P. M.), very rapidly the first day, and commenced closing again in about three hours, becoming entirely closed by midnight. The second night they opened more slowly, and commenced to close earlier, so that the final closing was again about midnight. The last two nights the motion was slower, but occupied about the same time on the whole. Mr. Redfield had noted, Mr. M. observed, that some Mentzelias opened by day and some by night, but he knew of no attempts to time the opening exactly.

In order to tell whether these openings and closings by night had anything to do with fertilization by insect agency, he had inclosed one flower in a gauze bag, and found it to have a seed vessel apparently as perfectly developed as the rest. The seed might possibly be imperfect when the seed vessel was mature, but this was hardly likely, as the instances where plants developed their capsules in the absence of fertilization were uncommon.

SEPTEMBER 19.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-eight members present.

Notes on the Coniferæ.—Dr. ENGELMANN, of St. Louis, spoke about *Abies Fraseri*, the very local species of the highest mountains of North Carolina, which he had just visited, together with several botanical friends, members of this society. This is the tree which caused these mountains to be designated as the Black Mountains; giving their summits that sombre hue for which they are known. They seem to grow nowhere but on these mountains, and only on those that reach up to or above 6000 feet altitude. The northern localities claimed for the species, rest on confusion with forms of *Abies balsamea*, the common northern balsam, of which our tree may be claimed to be the southern representative. *A. balsamea* does not seem to extend southward further than the Virginian mountain region; and it would be interesting to ascertain how near both species approach each other.

Besides the well-known characters of the cones and their cusps, excellent distinctions are found in the structure of the leaves of both species. It may not be generally known, though it is a fact to which, since several years, some European botanists have called attention, that the anatomical structure of the leaves of these

species, as well as of *conifers* in general, are extremely various, and that this structure well characterizes many species, and is one of the safest means to arrange them in natural groups. *Abies Fraseri* and *balsamea* are so nearly allied, that without fruit they are constantly confounded; but the structure of the leaves will always distinguish them so well, that a single leaf, or even a fragment of one, will invariably solve all difficulty. The leaves of *Abies* have under the epidermis, and between it and the cells of the parenchyma, which are full of chlorophyll, an arrangement of cells of thick walls, elongate form, and destitute of chlorophyll, analogous to bast cells, which have been called *hypodermic* cells; we find them in all species of *Abies* on the edges and on the keel, where they strengthen the leaf; but their distribution under the epidermis of the upper side of the leaf is very different in different species—they may be wanting there altogether or may be differently grouped, or may extend over the whole upper surface. Now in all forms of *A. balsamea* they are there almost entirely absent, even in those of the highest New England mountains; while *Fraseri* exhibits under the microscope a continuous hypodermic stratum of them.

These differences may seem minute and perhaps unimportant, but they remind us of similar structural differences in the higher or vascular cryptogams, in which on differences in variation and cell-structure much stress is laid, and justly so; while in higher developed plants the anatomical structure of the leaves is much more uniform.

This leads to another and much more important question, the position of the conifers in the vegetable world.

Conifers are usually placed at the bottom of the dicotyledonous plants, and Cycadeæ with the highest monocotyledons, near the Palms. Now, Robert Brown, more than fifty years ago, has shown that both differ from all other flowering plants, by bearing on open leaf-organs naked ovules; nor are their seeds inclosed in regular fruits, a peculiarity which has procured for them the name of gymnosperms. It must be admitted, however, that to this day the question, though diligently ventilated, is not entirely settled, or, to express it more correctly, gymnospermy is not yet acknowledged by every botanist.

Calling to our aid the investigations in another field of natural science, Palæontology teaches us that the lowest forms appear in the oldest epochs of our globe's history, and that only in the later periods the higher developed forms are found. Now, the fact is, that ages and ages before other flowering plants, angiospermous plants are found, and almost coëtaneous with the earliest cryptogamic land plants—in the Carboniferous and even in the Devonian periods conifers already made their appearance.

As in the development of the mammals, the prototypes of many of the orders are found anterior in their geological age, as well as

lower in grade of development; so the conifers, with their exogenous trunk and their often numerous cotyledons, will have to be considered the prototypes of the exogens, while the cycadeæ with endogenous trunk, and unequal or almost single cotyledons, are those of the endogens. Both together, comprised under the general term of gymnosperms, will eventually be acknowledged as a link intermediate between the vascular cryptogams and the flowering plants.

Naturalization of Plants.—Mr. MARTINDALE spoke of the various agencies by which foreign plants have been introduced into the country, also of the manner of their distribution, instancing the case of *Rudbeckia hirta*, L., now very abundant in the eastern section, having been introduced in grass seed from the west. He also mentioned a number of plants that are common on the coast of Virginia and southward, which have been collected in the lower counties of New Jersey, evidently from seed carried by birds in their migrations coastwise.

Within a few years large quantities of ballast have been deposited in the neighborhood of Philadelphia, on which have been collected a large number of plants not found elsewhere in the vicinity. Some of the species occur every year, and in some instances spread into the waste grounds; others have not appeared the second season, although their seeds became fully matured. He stated that this subject of introduction and establishment of foreign plants was becoming of more and more importance, as the geographical distribution of species was being investigated, and where reasons could be assigned, as to the manner of introduction, they give it an additional interest. He had, within a few days, collected, near the mouth of Wissahickon Creek, a plant which had been determined to be *Leonurus glaucescens*. A large number of luxuriant specimens were growing in the locality mentioned, and it appeared to be fully established. The plant is an entire stranger in this part of the country, and he could assign no way by which its introduction might have been effected at this time. It might possibly have been introduced from Siberia, by way of Japan, in some of the materials intended for the Centennial Exhibition.

SEPTEMBER 26.

Mr. EDW. S. WHELEN in the chair.

Thirty-four members present.

A paper entitled "Remarks on Ptiloris Wilsonii, Ogden," by Jas. A. Ogden, M.D., was presented for publication.

On Sphenes from Delaware County, Penna.—Dr. Wm. H. Forwood, U. S. A., communicated the fact that a number of sphenes of very large size and beautiful yellowish-green color have been taken from a quarry on the property of Jno. Mullin, near Bridgewater Station, Chester Creek R. R., Del. Co., Penna. The rock formation at this point consists for the most part of a hard, curled, garnetiferous gneiss, with here and there a narrow vein of quartz or feldspar.

Iron pyrites, hornblende, black mica, and a few staurolites have been noticed there. Near the eastern end of what is known as the middle quarry, there is a stratum of loose, dark-brown mica schist, permeated with a spring of water; and in the wettest portion of this, about ten feet from the surface, the sphenes were found in a small space in disseminated crystals, associated with loose crystals of quartz.

Unfortunately, the greater number of them were broken in blasting, and several are known to have been lost or destroyed; but he had collected pieces representing over thirty (30) distinct crystals from this one place. They vary from *one to three inches* in length, and all, without exception, present a twinned formation. Only three crystals escaped being broken. The largest is two and three-quarters inches long by an inch and a half across, and weighs eight hundred and sixty-four grains troy. The next in size is two inches long, and weighs five hundred and ten grains; and the smallest is an inch and five-eighths long, and weighs one hundred and ninety grains. He had prepared a plaster cast of each of these, which were presented, together with the fragment of a still larger crystal, being the largest one found, and weighing ten hundred and thirty grains. This is a new locality for sphenes, and these appear to constitute a new variety of that mineral in this State.

The Harmony of Antagonism of Teeth.—Dr. McQuillen directed attention to a human skull in which, owing to the loss of the bicuspids and molars in the left side of the lower jaw, an upper molar, failing to meet with the antagonizing teeth, protruded from the alveolus twice its original length. In addition to this, and from the same cause, the left superior maxilla had fallen considerably below the level of right superior maxilla, and, carrying with it the malar bone, had lowered the orbit to such an extent that the face must have been quite disfigured during life. There was a marked contrast between this and another skull shown, in which the thirty-two teeth were all in good condition, symmetrical in their arrangement, and illustrating in a marked degree the harmony of antagonism. During life the upper and lower teeth articulate with each other, so that when the jaws are closed they maintain each other in their positions. The incisors canines of the upper jaw overlap those of the lower so as

to conceal the upper third. The external cusps of the lower bicuspids and molars are received into depressions between the external and internal cusps of similar teeth of the upper jaw. No two teeth oppose each other only, but each tooth in closing the jaws impinges upon two, so that, should a tooth be lost, or even two alternate teeth, still the corresponding teeth of the opposite jaw are to some extent opposed, and thus remain useful. When a tooth is wholly unopposed, a process is set up in the jaw by which the useless organ is gradually extruded from the socket, as shown in the first skull.

Dr. Isaac T. Coates was elected a member.

Don Alvaro de la Gándara, of Madrid, Spain, Col. Juan J. Marin, of Barcelona, Spain, and Sig. Alessandro Castellani, of Rome, Italy, were elected correspondents.

The committees to which they had been referred recommended the following papers to be published:—

NOTE ON THE DISCOVERY OF REPRESENTATIVES OF THREE ORDERS OF FOSSILS NEW TO THE CRETACEOUS FORMATION OF NORTH AMERICA.

BY W. M. GABB.

It is not often, in a subject so long and so thoroughly worked over as has been the palæontology of the American cretaceous formation, that a student has the good fortune to discover at the same time the first representatives of three orders previously unknown. In a little lot of fossils from the "Timber Creek" or yellow limestone beds of the neighborhood of Vincenttown, New Jersey, recently found by Miss Frances H. Bryan, and presented by her through her father, Col. T. M. Bryan, to the Academy, I find the stem of an undescribed *Pentacrinite*, the first crinoid of the formation in the United States, and a number of plates of the first American cretaceous star-fish. In view of the unusual interest attached to these discoveries, I shall depart from the rule I have followed for several years, of abstaining from the description of isolated species and from imperfect material, and give the following brief diagnoses, in the hope of stimulating the search for these objects, thereby rendering our knowledge of them more complete:—

Pentacrinus Bryani, n. s. Pl. 5, figs. 1, 1*a*, 1*b*.

Known only from two fragments of the stem, one consisting of seven joints, the other of eight or nine. Stem distinctly pentangular, angles rounded; segments alternating, each alternate one more and less constricted in the longitudinal grooves. The less constricted segments are concavely rounded on the sides, while their alternates are cut on each side by a deep, acute indentation, giving them the appearance, as seen from above, of flowers with five rounded petals. Lateral surface of the segments convex and smooth; articular face slightly raised on the margin and radiately denticulate.

In style, this stem is nearest to *P. scalaris*, Goldf., from the Oxford, especially that form figured in Petr. Germ. Pl. 52, f. 3, b; but the angles are more rounded, and the flower-like appearance of the articular face of the segment is more marked.

Goniaster mammillata, n. s. Pl. 5, figs. 2, 2*a*, 2*b*.

About thirty marginal plates occur in the collection, some of which resemble in form those of *G.* (*Ast.*) *quinqueloba*, Goldf.,

Petr. Germ. Pl. 63, f. 5, b, c, d, except that they are somewhat shorter and thicker, and the pointed extremity is replaced by one truncated nearly straight across. But the most marked peculiarity of the present species lies in several marginal plates in the collection, corresponding with Goldfuss's fig. *e*. These are longer and narrower in form, and each bears on the end of the plate, which is acute in the European species, an elongated rounded protuberance, projecting beyond the end of the plate and overhanging it. Other smaller plates, about one-half longer than wide, are thinner, but retain the superficial outline of the first mentioned.

From the size of the plates, our species seems to be nearly of the same size as that with which I have compared it; but the difference in form, and the great rounded protuberance on the long plates, reversing the relative thickness of the two ends, will at once distinguish them.

Since writing the above, I have received from Col. Bryan another little fossil, so akin to the present subject that I add it. No Cirripedes have been reported from the American cretaceous, and his fossil is the carinal plate of a *Scalpellum*. On showing it to Mr. Conrad, he recognized it as being similar to a fragment in his possession from New Jersey, also from the white limestone, but of which the exact locality is unknown. Through the kindness of these two gentlemen, therefore, I have the means of making known the species, the more especially since Mr. Conrad's carina is accompanied also by a scutal valve of the same animal. The carina (figs. 3 and 3*a*) is large, indicating a size of about an inch and a half in length of the animal, without the stem. It has nearly straight sides, is very gently curved; external surface nearly flat at the upper part and rounded subangular below in the median line. Upper end acute, base rounded; inner face deeply concave; sides bearing a prominent linear rib which marks the three parts of surface into which Darwin divides this plate. This will be better understood by a reference to the cross-section, Pl. 5, fig. 3*b*, made across the middle of the plate. The scutal plate (fig. 4) is nearly straight on its occludent margin; the tergal margin is strongly sloping and a little concave at the apical portion; the base is straight or very slightly convex. The surface is slightly angulated, and marked by strong lines of growth. I propose for this rare fossil the name of *S. Conradi*, in recognition of the donor of the greater part of the material from which the description is drawn.

HEXAGONITE, GOLDSMITH, A VARIETY OF TREMOLITE.

BY GEORGE A. KOENIG, PH.D.

In a paper read by Mr. Goldsmith before the Academy (August 15, 1876), he described a new mineral occurring at Edwards, St. Lawrence Co., N. Y., for which he proposed the name hexagonite. According to his description the mineral is hexagonal in form, is optically uniaxial, and in composition is a bisilicate of magnesium, calcium, and sodium. Mr. Goldsmith assigns it a place in the *beryl* group. Upon inspection of the mineral, the habitus of the crystals struck me as being very little like that of a hexagonal mineral. Some of the crystals, especially the larger ones, have a decided tabular habitus, such as we often find in minerals of the rhombic, monoclinic and triclinic systems. The appearance of the mineral is altogether novel and striking; the fine light amethystine color, and a peculiar lustre, together with the aggregative entwining of the crystals, render it very attractive to the eye. My doubts as to the accuracy of Mr. Goldsmith's determination being roused, I resolved to examine the mineral myself, having been furnished with plentiful material, through Mr. Clarence C. Bement's kindness, who was the first in this city to obtain it.

System of Crystallization, *Monoclinic.* The crystals form rhombic prisms, showing the faces of a prism and of a pinakoid, the excessive development of the latter producing the tabular shape of the larger crystals. The section of the prism is, of course, a hexagon, but the peculiar mode of aggregation prevented the definite formation of the terminal faces. However, this want is partially supplied by a basal cleavage at such an angle that no doubt can exist as to the monoclinic character of the mineral.

The larger crystals cleave very perfectly according to the prism, and one face with greater perfection than the other, which speaks also for the monoclinic form of the mineral. The angle of cleavage was found 124° 35′.

From a large number of measurements, I select the results obtained from one crystal, which was quite small, but had even and splendent faces.

Readings.	Calculated angles.	Mean.
0° 00′ } 62° 30′ }	117° 30′	117° 38′
117° 43′	124° 47′	
242° 15′	117° 43′	124° 39′
297° 40′	124° 30′	
360° 00′	117° 40′	

The prismatic angle is therefore 124° 39′, corresponding very closely to that of tremolite, 124° 30′. *Color* pink, violet, amethystine; *lustre*, strongly vitreous; cleavage, basal, uneven and prismatic.

H = 6.5. Sp. gr. = 2.996, B. B.

Fuses to a white enamel in a strong flame. The white powder remains unchanged. With borax gives a pure amethyst glass in O. Fl., with sodium carbonate fuses to a glass, which is sky-blue when cold. These reactions indicate manganese. With cobalt solution reacts like an earthy silicate.

Composition.		Oxygen.	
SiO_2	= 58.20	31.021	
MgO	= 24.14	9.649	13.932
CaO	= 12.20	3.485	
Na_2O	= 1.90	0.490	
MnO	= 1.37	0.308	
$(Al_2O_3 + Fe_2O_3)$	= 1.40		
	99.21		

The oxygen ratio is therefore R : Si = 1 : 1.23, and the simplest expression is

$$(MgO, CaO)\ SiO_2$$

Now, if we compare with this the composition of tremolite from Gouverneur N. Y., a white variety, analyzed by Rammelsberg (Pogg. ciii. 299)—

SiO_2	= 57.40
MgO	= 24.69
CaO	= 13.89
$(Al_2O_3 + Fe_2O_3)$	= 1.74
$H_2O + F$	= 0.40
	98.12

we see that the new mineral differs from this only by having replaced a small percentage of magnesium and calcium by manganese and sodium. The manganese produces the distinguishing color.

REMARKS ON PTILORIS WILSONII, OGDEN.

BY J. A. OGDEN, M.D.

In my description of *Ptiloris Wilsonii* (Proc. Acad. Nat. Sci., p. 451, 1875), two important characters were considered as being sufficient upon which to establish the species; but, since the publication of the article, it has been observed that the legs and feet are those of another bird.

This specimen was presented to the Academy by Dr. T. B. Wilson as coming from the Rivoli Collection, and no doubt the present legs and feet were substituted for the absent ones so as to complete the mounting of the bird. This was not noticed at the time the bird was described, and credit is due to Mr. D. G. Elliot for directing my attention to it.

Reliance, however, may be placed upon the other characters—the extent of the metallic-colored feathers of the neck and breast, which differ from *Ptiloris magnificus* in that they are not confined to the centre of the throat, but extend around beneath the eyes, covering the sides of the neck, as well as in front. Now, whether this difference be due to the manner in which the specimen has been prepared, or not, remains yet to be fully determined, and cannot be without further investigation; if it is, then *Ptiloris Wilsonii* will have to stand as a synonym of *Ptiloris magnificus*.

ON THE LINGUAL DENTITION, JAW, AND GENITALIA OF CARELIA, ONCHIDELLA, AND OTHER PULMONATA.

BY W. G. BINNEY.

Macrocyclis sportella, Gld.

Oregon. Mr. O. B. Johnson.

Jaw and lingual membrane as usual in the genus. (See Proc. Acad. Nat. Sci. Phila., 1875.)

Teeth 22—1—22. The 6th tooth is the largest. The peculiar side spur noticed on the inner laterals of *Macr. Vancouverensis* is present in this species also. The central tooth is of same type as that of the last-named species, to which *sportella* is most nearly allied by its shell. Pl. VI., fig. AA.

Zonites inornatus, Say.

Pl. VI., fig. C, represents the dentition of this species, showing both planes of the cusps and cutting points. The dotted lines show the lower plane, *i. e.*, the part which rests on the base of attachment. This is what I have hitherto shown in my plates. From this lower plane the cusp and cutting point bulge out laterally as they round upwards. The most outward margin is the other plane shown, giving the widest extension of the cutting point.

Zonites fuliginosus, Griff.

On pl. VI., fig. D, is a lateral tooth of this species showing the two planes described under *Z. inornatus*.

Zonites(?) Bermudensis, Pfr.

Bermuda. Mr. J. Matthew Jones to Mr. Bland.

The specimens were living, enabling me to study advantageously the external characters of the animal. There is a distinct locomotive disk to the foot, but no caudal mucus pore, and no longitudinal furrows above the margin of the foot, so that the species cannot be placed in *Zonites*, which has the last two characters. The external orifice of generation is quite under the mantle, not behind the right eye-peduncle.

The jaw and dentition I have already described. (Ann. Lyc. Nat. Hist. of N. Y., X., 221.)

The genitalia present the following peculiarities. The genital bladder is small, globular, on a long duct. The penis sac is long,

tapering to its apex, where it receives the vas deferens and the retractor muscle. There is a long, stout, dart sac, containing a delicate, arrow-like dart of the same form as figured by Leidy for *Zonites ligerus* (Terr. Moll., U. S. I.).

The absence of the caudal mucuspore removes the species from *Zonites*, nor can it be placed in any recognized genus.

Limax Hewstoni, J. G. Coop.

California. Dr. Cooper.

Pl. VI., fig. F, represents the genitalia of this species, which I have recently drawn from specimens kindly furnished by Dr. Cooper. For description, see Ann. Lyc. Nat. Hist. of N. Y., XI., p. 22.

Limax campestris, Binney, var. **occidentalis**.

California. Dr. J. G. Cooper. (See Proc. Acad. Nat. Sci. of Phila., 1872, 146, pl. III., fig. c.)

In outward appearance, in genitalia and in jaw, this form cannot be distinguished from the eastern form. Its lingual membrane has 35—1—35 teeth, 13 being laterals. On some of both the inner and outer marginals I can detect the side spur which in the eastern form I have only observed in the outer marginals. In this particular, *occidentalis* is more nearly allied to *L. montanus*, Ingersoll,[1] but when the value of differences in such slight details becomes known, I believe all three species will be found identical.

Pl. VI., fig. X, *b*, gives two inner marginals.

Onchidella borealis, Dall.

Alaska. Dr. W. H. Dall.

In three specimens examined I found a jaw (pl. VI., fig. BB), low, wide, slightly arcuate, ends scarcely attenuated, blunt, anterior surface ribless.

Lingual membrane (pl. VI., fig. EE) long and wide. Teeth about 61—1—61, arranged strongly en chevron. The central tooth is large, longer than wide, truncated above, expanded below its middle, and incurved at the basal margin. The reflection is large, tricuspid, each cusp bearing a decided cutting point. The side teeth have a long, narrow base of attachment, a small portion of its upper portion thrown outwards, the balance curving inwards, giving an irregular bow-shape to the whole base of attachment—

[1] This is the species indicated by me as *L. Ingersolli*, in Proc. Acad. Nat. Sci. Phila., 1875, 176.

whose upper and lower edges are abruptly truncated. The reflection is near the base, and consists of a very small, inner cusp, bearing a small conical cutting point, and another, outer, larger cusp, bearing an extraordinarily developed, wide, expanding, bluntly truncated cutting point. As the teeth pass outwards towards the outer margin of the membrane, they at first increase and then decrease in size, but retain the same shape quite to the edge.

An outer lateral tooth is figured in *c*, an inner lateral in *b*.

Fig. E, of plate VI., gives a view of the lower surface of the animal and also one of the head, showing the short, stout eye peduncles and curious oral appendages.

The *Onchidiidæ* are described as agnathous, but I am confident of having observed the jaw figured.

Arielimax Columbianus, Gld.

From Mr. O. B. Johnson, of Forest Grove, Oregon, I have received specimens of this species. On examining the genitalia, I find them to agree perfectly with what I have already figured in Proc. Acad. Nat. Sci. of Phila., 1874, pl. XI., fig. c. I am convinced, therefore, of the identity of the specimens there figured, of which some doubt then existed.

Binneya notabilis, W. G. B.

Sta. Barbara Island, California, Mr. Henry Hemphill.

Pl. VI., fig. v, represents almost the whole of the genital system. The penis sac is long, narrow, tapering at its apex, where it receives the vas deferens: the retractor muscle is inserted below the entrance of the latter. The genital bladder is oval, on a long, narrow duct. There is a small, saclike, accessory organ, probably a dart sac.

Carelia bicolor, Jay.

Dr. W. H. Dall.

Through the kindness of Dr. Dall, I have been able to examine this species, formerly known as *Achatina bicolor*. Thus I have increased the list of subgenera or groups of *Achatinella* of Gulick's arrangement, whose jaw and lingual dentition is known, leaving still to be examined *Newcombia* only of the same arrangement.

It will be seen from my description, that while Carelia (or at least this species) differs utterly in jaw and dentition from Gulick's Achatinella s. s., Bulimella, Apex, Partulina, Auriculella, it agrees

in dentition with his Laminella, Amastra, Leptachatina, but differs in having a costate jaw. Carelia, therefore, must stand distinct from any of the other groups of Achatinella.

My description and figures should be studied in connection with my former papers on Achatinella in Annals of Lyceum of Natural History of New York, Vol. X., p. 331, pl. xv., and Vol. XI., p. 190, pl. xiv., in the preparation of which I was assisted by Mr. Bland.

The animal is obtuse before, pointed behind. The mantle appears subcentral in the single individual examined, which is preserved in alcohol. The orifice of respiration and anal orifice are as usual in the heliciform genera. The genital orifice as far as I can judge is somewhat removed from behind the right eye peduncle, rather under the mantle edge, but it is difficult to say what is its position in the living animal. There is no sign of a distinct locomotive disk or of a caudal mucus pore.

The jaw (pl. VI., fig. G) is low, slightly arcuate, with but little attenuated, blunt ends: anterior surface with ten stout ribs, denticulating either margin.

Lingual membrane (pl. VI., fig. CC) long and narrow. Teeth 37—1—37 of same type as I have formerly described (l. c.) for species of Laminella, Amastra, and Leptachatina, the marginals being irregularly and obliquely pectinate as in Achlla. obesa (l. c.).

The digestive system, as would be anticipated from the shape of the shell, is characterized by the extreme length of the œsophagus. The salivary ducts are comparatively short. The salivary glands are small and in a globular mass around the œsophagus. The buccal mass with its pouch of the lingual membrane is as usual: its retractor muscle is attached to the retractor of the head.

The genitalia are here figured (pl. VI., fig. O). It will be seen that there is in the specimen examined a decided external swelling of both male and female (the former, female (*f. o.*), large and horn-shaped, the latter, male (*m. o.*), small and globular) organs; owing, perhaps, to the sudden immersion of the individuals in alcohol. The gravid state of the uterus precludes the possibility of these swellings being preparatory to accouplement This condition of the external orifices accounts for the wide separation of the genital bladder from the vagina, and of the accessory organ (*pr.*) from the penis sac. The figure is of life size, all the organs having been accurately measured. The testicle (*t.*) is composed of short cœca grouped in a globular mass. The epididymis (*ep.*) is short and

greatly convoluted. The ovary (*o.*) is obtusely tongue-shaped and lobate. The oviduct is sacciform and contained two well-developed embryonic shells, showing the species to be viviparous, as well as four masses, probably consisting of less mature embryos. The genital bladder is small, suboval, on a short duct. The penis sac (*p. s.*) is long, cylindrical, with a developed, extended median constriction. The vas deferens (*v. d.*) enters the apex of the penis sac: the retractor muscle (*r. p.*) of the penis is inserted just above the entrance. There is a long, narrow, accessory organ (*pr.*) with an extended median constriction to the penis sac, perhaps a dart sac or prostate gland. There is a stout retractor muscle (*r.*) to the external horn-shaped swelling of the male orifice.

Microphysa incrustata, Pcey.

Corpus Christi, Texas. A dried specimen collected over thirty years ago by Mr. Bartlett.

Jaw low, wide, slightly arcuate, ends blunt, but little attenuated: anterior surface with numerous, crowded ribs, bluntly denticulating the lower margin.

Lingual membrane (pl. VI., fig. T) with 13—1—13 teeth, 5 perfect laterals. The teeth are of same type as in other species of *Microphysa*, as *Ingersolli* (Ann. Lyc. of N. H. of N. Y., XI., pl. xviii., fig. c). The jaw also resembles that of *Microphysa* rather than *Patula*, to which I formerly referred the species. Von Martens places it in *Microphysa*. Fig. *b* shows marginal teeth.

Triodopsis inflecta, Say.

Indiana. Mr. F. Stein.

Genitalia as in *T. Rugeli*. See Ann. Lyc. Nat. Hist. of N. Y., XI., pl. xvi., fig. 18.

Turricula tuberculosa, Conr.

Palestine. A dried specimen in Mr. Bland's collection.

Lingual membrane (pl. VI., fig. J) long and narrow. Teeth 28—1—28. Centrals and laterals without decided side cusps or cutting points, but the central cutting point has a decided lateral bulge. Marginals low, wide, with one inner, oblique, large bifid cutting point, and two outer smaller cutting points. A marginal is shown in *f*.

Jaw with numerous, crowded, broad, flat ribs, denticulating either margin.

Helix monodon, Rackett.

Indiana. Mr. F. Stein.

Genitalia (pl. VI., fig. Q) characterized especially by a very unproportionally large penis sac, which is long, club-shaped, greatly enlarged above, where it receives the vas deferens and retractor muscle. The genital bladder is elongate-oval, small, on a short, delicate duct. The epididymis is convoluted throughout its length.

Polygyra Postelliana, Bland.

Charleston, S. C. Mr. W. G. Mazyck.

Genitalia as in *P. auriculata.* (See Leidy in Binney's Terr. Moll. U. S. I.)

Jaw as usual in the genus: over 12 ribs. Lingual membrane (pl. VI., fig. z) as in *P. Hazardi.* (See Proc. Acad. Nat. Sci. Phila., 1875, pl. viii., fig. 5.) The change from laterals to marginals is very gradual, and formed without the splitting of the inner cutting point. There are 21—1—21 teeth with about 7 laterals. Extreme marginals are shown in *b.*

Polygyra Dorfeuilleana, Lea.

A dried specimen long preserved in my cabinet furnished the lingual membrane here described.

Teeth (pl. VI., fig. U) 20—1—20, with 9 laterals, the tenth tooth having its inner cutting point bifid. Base of attachment subequilateral of central and lateral teeth. All the teeth of same type as in *P. auriculata.* (See Ann. Lyc. of Nat. of N. Y., XI., pl. xviii., fig. E.)

Polygyra avara, Say.

Banks of St. John's River, Florida. Mr. Chas. Dury.

It is with peculiar satisfaction that I give these details, as it is one of our rarest species.

Jaw as usual in the genus, with over 12 ribs. (See Proc. Acad. Nat. Sci. Phila., 1875, p. 201.)

Lingual membrane as usual in the genus (see same, p. 202). The change from laterals into marginals is shown in the 9th tooth, which is the first having a bifid inner cutting point. There are 17—1—17 teeth. Pl. VI., fig. Y.

Caracolus sagemon, Beck.

Gonave Island. Prof. Linden to Mr. Bland.

On pl. B, fig. GG, I figure the dentition of the specimens described in full by Mr. Bland in Ann. Lyc. Nat. Hist. of N. Y., XI., 197 (1875).

Mesodon major, Binn.

This species (or form of albolabris) was found by me near Aiken, S. C., but still larger specimens, at Macon, Ga., in the City Cemetery, by Mr. H. S. Crooke. The form seems to inhabit a narrow strip of territory east of the mountains from Abbeville, S. C., to the Gulf of Mexico. The largest specimen I have ever seen is 48 mill. in its greater diameter.

The jaw, lingual dentition, and genitalia agree with those of *albolabris*. Fig. I, of plate VI., represents the genital system of one individual examined, in which the ovary is very small, and the genital bladder unequally divided, both points differing from those of other individuals examined. This shows us we should allow some latitude of variation in the details of the genital system of any given species.

Aglaja fidelis, Gray.

Oregon. Mr. O. B. Johnson.

On pl. VI., fig. P, I give a more satisfactory figure of the genitalia of this species than formerly published by me. The organ *x* in the specimens recently examined was greatly developed. The organ is a dart sac, which contained a dart of the type described below under *Arionta Mormonum*.

Arionta Mormonum, Pfr.

Tulumne Co., California. Mr. A. W. Crawford.

Pl. VI., fig. S, represents the genitalia. The general appearance is that of *A. fidelis*, as formerly described by me (see below), but there is an additional accessory organ (*q*.), of use unknown to me. The organ, *r*, is a dart sac. The dart is short, stout, straight, swollen at its base, and with an enlarged acutely pointed apex (pl. VI., fig. K). Upon the vagina, above the insertion of the penis sac, is a ridge-like process (*s*.) containing in three individuals examined one round, and one oblong calcareous nodule (pl. VI., fig. J). I suspect the organ 14, noticed in *fidelis* (Proc. Acad. Nat. Sci. Phila., 1873, pl. I., fig. 5) corresponds with this process.

Jaw as usual in Arionta: 7 ribs.

Lingual membrane (pl. VI., fig. B) as usual in Arionta. Teeth 50—1—50, with 15 laterals, the 16th tooth having its inner cutting point bifid.

Arionta sequoicola, J. G. Coop.

Santa Cruz, California. Mr. H. Hemphill.

The genital system (pl. VI., fig. R) is like that of Arionta Traski.

(See Ann. Lyc. of Nat. Hist. of N. Y., XI., pl. VI., fig. IV.) The accessory bulb upon the vaginal prostate is somewhat differently situated in this species. The extreme length of the genital system is eighty-seven millimetres.

Jaw and lingual membrane already described. (See Proc. Acad. Nat. Sci. Phila., 1874, pl. XIV., fig. 5.)

Arionta Californiensis, Lea.

Monterey. Mr. H. Hemphill.

Jaw already described.

Lingual membrane with 53—1—53. Teeth as usual in the genus (see above). The side cusp and cutting point appears on the 9th tooth. The inner cutting point of the 25th is bifid, so that there are about 24 laterals (pl. VI., fig. W).

The genitalia are as in *A. Nickliniana* already described.

Arionta Dupetithouarsi, Desh.

Monterey. Mr. H. Hemphill.

Jaw as usual in the genus, with four, separated, stout ribs.

Lingual membrane with 50—1—50 teeth. There are no distinct side cusps or cutting points on the centrals or first laterals, though there is a lateral bulge on the large cutting point. The distinct side cusp and cutting point appears on the ninth tooth. There are about nineteen laterals, the twentieth tooth having its inner cutting point bifid. The marginals are as usual in the genus (pl. VI., fig. U).

Genitalia as in *A. Traski* (l. c.). The penis sac is more slender and has no retractor muscle in the single individual examined by me. The oviduct is greatly convoluted.

Glyptostoma Newberryanum, W. G. B.

San Diego, Cal. Henry Hemphill.

Genitalia (pl. VI., fig. H). *x* is a dart sac or prostate gland.

Bulimulus Dormani, W. G. B.

Port Orange, Florida. Mr. Chas. Dury.

Jaw (pl. VI., fig. M, the central portion only) as usual in the genus, arcuate, thin, transparent, ends acuminated, anterior surface with about 54 plait-like ribs. The figure gives only a portion of the jaw. The upper median ribs are very oblique.

Lingual membrane as in *B. laticinctus*, *primularis*, *papyraceus*, etc. Teeth 79—1—79. Pl. VI., fig. HH. This is the first species of

Bulimulus noticed within the United States having this peculiar type of dentition.

Genitalia figured on pl. VI., fig. N. Penis sac very long and narrow, ending in a flagellum: vas deferens entering at about the anterior fourth of its length. Genital bladder oval, on a long, narrow duct. No accessory organs.

Bulimulus Edwardsi, Mor.

Lake Titicaca. Prof. Alex. Agassiz.

Jaw low, arcuate, ends rapidly acuminated, blunt: anterior surface with over ten distant ribs, some of the usual *Helix* type, others like the plait-like processes, common in *Cylindrella*, *Bulimulus*, *Gæotis*, *Amphibulima*, etc.

Lingual membrane (pl. VI., fig. DD) with 44—1—44 teeth. Centrals of the usual *Helicinæ* type, tricuspid: laterals like centrals, unsymmetrical, and consequently bicuspid. The change to marginals very gradual, and formed by the simple modification of the laterals, without any splitting of the inner cutting point.

Succinea ovalis, Gould, not Say.

Burlington, New Jersey.

Teeth over 60—1—60. Fig. *b* represents extreme marginals (pl. VI., fig. A).

Jaw with smooth anterior surface and prominent median projection to the cutting edge.

EXPLANATION OF PLATE VI.

Fig. A. Lingual dentition of Succinea ovalis.
Fig. B. " " Arionta Mormonum.
Fig. C. " " Zonites inornatus.
Fig. D. " " " fuliginosus.
Fig. E. Onchidella borealis.
Fig. F. Genitalia of Limax Hewstoni.
Fig. G. Jaw of Carelia bicolor.
Fig. H. Genitalia of Glyptostoma Newberryanum.
Fig. I. " Mesodon major.
Fig. J. Lingual dentition of Turricula tuberculosa.
Fig. K. Dart of B.
Fig. L. Calcareous concretions of B.
Fig. M. Jaw of Bulimulus Dormani, central portion.

Fig. N. Genitalia of M.
Fig. O. " Carelia bicolor.
t. Testicle.
ep. Epididymis.
o. Ovary.
ovid. Oviduct.
g. b. Genital bladder.
p. s. Penis sac.
r. p. Retractor penis.
r. Retractor.
pr. Prostate gland?.
v. d. Vas deferens.
m. o. Male orifice.
f. o. Female orifice.
e. t. External tegument.
Fig. P. Genitalia of Aglaja fidelis.
Fig. Q. " Stenotrema monodon.
Fig. R. " Arionta sequoicola.
Fig. S. " B.
Fig. T. Lingual dentition of Microphysa incrustata.
b. Marginals.
Fig. U. Lingual dentition of Arionta Dupetithouarsi.
Fig. V. Genitalia of Binneya notabilis.
Fig. W. " Arionta Californiensis.
Fig. X. " Limax occidentalis.
b. Inner marginals.
Fig. Y. Lingual dentition of Polygyra avara.
Fig. Z. " " " Postelliana.
Fig. AA. " " Macrocyclis sportella.
Fig. BB. Jaw of E.
Fig. CC. Lingual dentition of G.
Fig. DD. " " Bulimulus Edwardsi.
Fig. EE. " " E.
b. Inner marginals.
c. Outer marginals.
Fig. FF. Lingual dentition of Polygyra Derfeuilleana.
Fig. GG. " " Caracolus sagemon.
Fig. HH. " " M.

OCTOBER 3.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

A paper entitled "On the Extrusion of the Seminal Products in Limpets, with some Remarks on the Phyllogeny of Docoglossa," by W. H. Dall, was presented for publication.

Bituminous Sediment of the Schuylkill River.—Prof. LEIDY remarked that he had been recently invited by Dr. Josua Lindahl, Secretary of the Swedish Commission, who had at his command a small steamer, to make the experiment of dredging in the Schuylkill River. He had accepted the invitation in the expectation of finding abundance of the smaller aquatic animals, such as he had sparingly detected on stones near shore below low-water mark, just below Fairmount dam. The dredging was tried near the mouth of the Schuylkill, but no living thing whatever was drawn up, as the mud and sand were black and saturated with bituminous oil. This latter fact was unexpected, and would appear to illustrate the mode of formation of more ancient bituminous shales. The refuse of the city gas-works, and probably of some coal-oil refineries, run into the river. The oils appear to have an affinity for the particles of clay carried down the river, and, precipitating, become bituminous sediments at the bottom. In the same manner oils, from a profusion of decomposing animals, and probably also plants, supplied the sedimentary muds of ancient shales. Many even of the lowest plants contain abundance of oil, and it may be observed in such forms as Vaucheria, Diatomes, etc.

Fertilization in Beans.—Mr. MEEHAN observed that in all the discussions on the injurious effect of close breeding in flowers, and the consequent theories of cross fertilization, nearly all the arguments were drawn from structure. We are asked to note certain arrangements, and then to believe that certain results must follow. He preferred to watch the plants in their actions, and in the results of their actions when excluded from external agencies, believing it the more practical way and preferable to the theoretical one. One of his friends who thought he was wrong in limiting insect agency to a few plants, and in questioning the injury from vegetable close breeding, had been giving for some months past a series of articles in proof of his side, which was the generally accepted view. Of course the position of his friend was entitled to all the benefit to be derived from structural arrangement; but when he referred to actual behavior in plants, it came within the province he had marked out for himself. In the last paper there was an instance of this kind. After noting how the flowers of

Phaseolus, the common bean, were formed; and the supposed impossibility of fertilization by its own pollen, the paragraph concludes as follows: "The *machinery* tells its own story plainly. The confirmation is familiar to all who know beans and their facility of mixing when different varieties are grown together." Mr. M. said he claimed to "know beans" for thirty years past; and had grown large numbers of varieties side by side, saving seed from them and re-sowing, and had never known a single case of admixture from this close proximity. The various kinds of both Beans and Peas in cultivation were in all cases evolutions, or, as would be commonly said, "sports or accidents," or were the results of actual manipulations by skilful seed raisers. He had no hesitation in saying that his friend was utterly wrong in his impression of the facts; that he did not "know beans;" and the fact that beans would not mix, though so close together, and so freely visited by bees, was an excellent argument against instead of for the generally received theories of insect cross fertilization.

Fruit of Akebia quinata.—Mr. THOMAS MEEHAN exhibited a fruit from a plant grown by Mr. W. Canby, of Wilmington, Del., who had three fruits from two old plants, and they were the first fruits he had heard of, after twenty years of extensive cultivation in America. In China and Japan, where it is a native, it is regarded as an edible fruit, and, inferring from its having a vernacular name, *Fugi-Kadsura-Akebi*, the fruit is probably common there. Attempts had been made to induce fruitfulness here by cross fertilization, but they had failed. It was not, therefore, a question of fertilization, but one of nutrition. The fruit is as large and of the appearance of a papaw (*Asimina triloba*), but opens on one side as in a follicle of *Asclepias*, disclosing the long column of parietal seeds. Mr. M. pointed out by it the difference between the Lardizabilaceous and Menispermaceous orders.

Note on Phallus fœtidus.—Mr. MEEHAN exhibited specimens of what he supposed to be a variety of this fungus. It was very rare with him, the last time it had appeared on his grounds was seven years ago. Its brilliant scarlet color and strong fetid odor would have attracted attention had it been in existence during that time. It was doubtful if any existed in the vicinity, and it was an interesting question whether the spores or mycelium had been in the ground all that while, or whether it had been recently brought as a spore in the atmosphere. But the main point he wished to draw attention to was the attraction the fetid plant had for meat flies. They abounded on the plants. The common toad plant of greenhouses (*Stapelia variegata*) attracted these in the same way, and it was said to be a scheme to aid the plant in cross fertilization, the stench attracting the flies, and inducing them to deposit eggs under the impression it was rotten meat; though what benefit it

was to the fly to be thus fooled had never been made clear to him. In the case of this fungus, however, it would hardly be contended that the flies had been deceived for the purposes of fertilization, nor could he understand why "in-and-in breeding," if bad for phænogams, should not be injurious to a fungus as well.

OCTOBER 10.

Mr. VAUX, Vice-President, in the chair.

Thirty-two members present.

Destructive Coleoptera.—Dr. LE CONTE mentioned that a small Coleopterous insect had recently proved quite destructive to carpets in houses in Albany and neighboring towns in New York. Mr. J. A. Lintner had sent him some specimens of the larvæ a few weeks ago, which proved to belong to some species of Dermestidæ, of unfamiliar form. Recently Mr. Lintner succeeded in rearing one of the larvæ, and sent the imago for examination. It was immediately recognized as *Anthrenus scrophulariæ*, a very common European species, not before reported as occurring in the United States. Herbst, Käfer, vii. 328, mentions that the larvæ destroy natural history collections, clothes, furs, leather, and edibles (Esswaaren).

Remarks on the Structure of Precious Opal.—Prof. LEIDY stated that Signor A. G. Arevalo, proprietor of one of the opal mines in Queretaro, Mexico, had recently called upon him, and exhibited a large collection of cut opals of various kinds, comprising the milk-white opal with a rich harlequin display of colors, the less valued transparent glassy variety with rich hues, and the red fire opal of different shades, also displaying the play of colors of the spectrum. From among them he had selected several which he exhibited to the Academy as illustrating in an unusually distinct manner the structure of the precious opal.

One of the specimens is white opal, emiting on one side from the free surface a brilliant display of colors. These are reflected from facets ranging from ¼ to 1 mm. in breadth, and of irregular polyhedral form, as represented in figure 1. The facets are distinctly separated by fissures, which, in the polishing of the stone, have become more or less filled with dirt, and they appear to form the surface of a mosaic pavement laid on a basis of amorphous opal, of which the other side of the specimen consists. The facets are distinctly striate; the striæ being parallel on the same facet, but changing in direction on the different ones, though pursuing the same general course over comparatively large areas, as represented in the same

Fig. 1.

figure. The striæ, or tubes as Sir David Brewster considered them to be, vary in degree of fineness; some apparently being double or more the thickness of others. He had not attempted to measure them accurately, but they appear to be about the size of the lines in the ordinary micrometer eye-piece of the microscope. There appeared usually to be about 4 or 5 striæ in the space of $\frac{1}{40}$th of a mm.

Another specimen is a dark carnelian-hued fire-opal, which exhibits in directly looking upon it, just beneath the surface, a patch of round or oval spots of a deeper hue. The spots range from $\frac{1}{4}$th to 1 mm. in breadth, and are separated by interspaces from $\frac{1}{8}$th to $\frac{3}{8}$th of a mm. The appearance of a portion of the specimen magnified is represented in figure 2. The spots appear as lenticular disks with finely striated surfaces; the striæ being parallel, and on the different spots pursuing nearly the same course. Viewed at a certain angle, they mainly emit a rich golden-green hue.

Fig. 2.

In another opaque white specimen, emitting rich hues, the striated facets are more or less isolated by amorphous opal, and vary much in size, as represented in the magnified figure 3. The smaller facets are generally irregularly oval; the larger ones appear to be made up of an aggregate of the smaller kind. Over comparatively large areas, the striæ of the different facets pursue nearly the same direction, but in contiguous areas they even pursue quite opposite directions, as represented in figure 3. On the larger patches, also, as I have attempted to represent them, the striæ are not perfectly continuous, but appear to be rather interrupted in bands. On another part of the same opal the brilliant patches would appear to pertain to cylindroid or fusiform rods of the striated opal imbedded in amorphous opal, as represented in figure 4. The striæ in these rods appear to be arranged in regular parallel layers, so that either longitudinal or transverse sections give rise to the appearance of parallel striæ.

Fig. 3.

Fig. 4.

From these specimens precious opals would appear to be constituted of an aggregation of particles of a striated or finely tubular structure which may be imbedded in a basis of more amorphous opal. When isolated by the latter, the particles may appear as lenticular disks, round or oval balls, or cylindrical rods with rounded ends and of variable length. When closely aggregated, these particles become more or less

polyhedral. The particles in section in any direction present a striated appearance, and, according to the varying fineness of the striæ, and their inclination, emit the varied hues for which the precious opal is so much admired.

Observations on Rhizopods.—Prof. LEIDY stated that last July, in the sphagnum swamps of Tobyhanna, Pocono Mt., Monroe Co., Pa., he noticed an abundance of a Rhizopod which he thought he had not previously seen, and which he at first supposed to be an undescribed species, but which he now viewed as a variety of *Hyalosphenia ligata*. From this, as previously described, it differs in the test being of a pale sienna color, and perhaps of greater thickness, but otherwise is like it. The test is compressed pyriform, with the length and breadth nearly or about equal, and the thickness one-half. The lateral borders are obtusely rounded. The mouth is transversely oval. The sarcode is colorless, and attached to the inside of the test by diverging threads. The pseudopods are usually from two to three. Measurements, .08 mm. long and broad, and .036 thick, with the mouth .02 broad and .008 wide. Others varied from .06 long and .08 broad, to .092 long by .064 broad.

In observing the Pocono variety of *Hyalosphenia ligata*, and the beautiful and well-marked species *Hyalosphenia papilio*, he detected an important point of structure which previously had escaped his notice. In the active condition of these, and other Difflugians, they are seen with one or more pseudopods extended from the mouth of the test, to the margin of which the sarcode is attached, as well as by diverging threads to various points of the interior of the test. The interval between the body of the sarcode and the interior of the test is occupied with water. The extent of the interval increases with the increase in number and extent of protrusion of the pseudopods, and also varies according to the degree of emptiness or repletion with food of the sarcode body. When the pseudopods are withdrawn into the mouth of the test, the mass of the sarcode expands in a corresponding ratio, and the threads of attachment to the inside of the test contract in length. The intervening water appears to be displaced through small apertures of the lateral borders and fundus of the test, which exist in numbers usually from two to half a dozen or more, as represented in the figure.

Hyalosphenia papilio. The arrows are directed to two of the apertures through which the water escapes when the animal retracts its pseudopods.

While speaking of Rhizopods, he would ask the indulgence of the Academy to listen to some remarks on recent observations on the habits of several species of Amœba.

One of the species of Amœba which he had most commonly seen, he took to be the

Amœba verrucosa of Ehrenberg, with which the *A. natans* of Perty, and the *A. terricola* of Greef, appeared to him to be synonymous. This species he had found in many places: in the crevices of the brick pavement in the yard attached to his residence, in brick ponds, in the ooze of the rocky shores of the Schuylkill River, in sphagnum swamps, in marsh mud, etc. It is remarkable for its sluggish character; and in appearance reminds one of a little pile of epithelial scales, or fragment of dandruff from the head. Appearing quadrately oval or rounded, transparent, and more or less wrinkled, or marked with delicate wavy lines; the pseudopods rise in short obtuse mammillary eminences or wave-like ridges, the summits of which are composed of transparent ectosarc, while the central portion of the body is occupied by a thin, pale, diffused, and finely granular entosarc. This contains one or more vesicles, usually one, which very slowly enlarges, and then less slowly collapses. In addition, as part of the structure, an oval granular nucleus is sometimes visible. The food contents generally appear not to be abundant, and often the creature appears to be empty of food altogether. The character of its food is the same as with other species of Amœba. It not unfrequently feeds on Difflugians. In a specimen from sphagnum water, from Vineland, N. J., last August, he observed an individual, about the $\frac{1}{10}$ of a millimetre, containing a Difflugia and a Trinema together. As observed by him, the species ranges from $\frac{1}{25}$ to $\frac{1}{6}$ of a millimetre in diameter.

On the morning of August 27, from some mud adhering to the roots of *Sparganium*, obtained the day previously in a nearly dried-up marsh, at Bristol, Pa., he obtained a drop of material for examination with the microscope. After a few moments he observed an *Amœba verrucosa*, nearly motionless, empty of food, with a large central contractile vesicle, and measuring $\frac{1}{25}$ of a millimetre in diameter. Within a short distance of it, and moving directly towards it, was another and more active Amœba, the species of which he was not positive. It was, perhaps, the one described by Dujardin as *A. limax*, by which name, for the present purpose, it may be called. As first noticed, this Amœba was limaciform, $\frac{1}{6}$ of a millimetre long, with a number of conical pseudopods projecting from the front broader end, which was $\frac{1}{15}$ of a mm. wide. The creature contained a number of spherical food vacuoles with sienna-colored contents, a large diatome filled with endochrome, besides several clear vacuoles, a posterior contractile vesicle, and the usual granular entosarc. The *A. limax* approached and came into contact with the motionless *A. verrucosa*. Moving to the right, it left a long finger-like pseudopod curved around its lower half, and then extended a similar one around the upper half until it met the first pseudopod. After a few moments the ends of the two pseudopods actually became connate (the second time he had observed this phenomenon), and the *A. verrucosa* was inclosed

in the embrace of the *A. limax*. The latter assumed a perfectly circular outline, and after awhile a uniformly smooth surface; but the central contractile vesicle remained in the same condition, nor did he once observe it enlarge or collapse. The *A. limax* now moved away with its new capture, and after a short time what had been the head end contracted, became wrinkled and villous in appearance, while from what had been the tail end a number (ten) of conical pseudopods projected. The *A. verrucosa* assumed an oval form, and the contractile vesicle became indistinct, without collapsing. Moving on, the *A. limax* became more slug-like in shape, measuring about $\frac{1}{7}$ m. long, by $\frac{1}{28}$ m. broad. The *A. verrucosa* now appeared inclosed in a large oval clear vacuole, was constricted so as to be gourd-shaped, and had lost all traces of its contractile vesicle. Subsequently, the *A. verrucosa* was doubled upon itself; and at this period, the *A. limax* discharged from one side of the tail end, the siliceous case of the diatome, which now contained only a shrivelled cord of endochrome. Later the *A. verrucosa* was broken up into five spherical granular balls, and these gradually became obscured and apparently diffused among the granular contents of the entosarc of the *A. limax*. At one moment the five granular balls derived from the *A. verrucosa* appeared to be contained in three vacuoles, and the *A. limax* had a more contracted and radiate form, and then measured $\frac{1}{12}$ m. in diameter.

The observation, from the time of the seizure of the *A. verrucosa* to its digestion, or disappearance among the granular matter of the entosarc of the *A. limax*, occupied seven hours.

From naked Amœbæ, the test protected rhizopods were no doubt evolved, and it is a curious sight to observe them swallowed, home and all, to be digested out of their home, just as the contents of diatomes are digested. It was also interesting to observe the cannibal Amœba swallowing another, and appropriating its structure to its own, just as we might do a piece of flesh, completely, without there being any excrementitious matter to be voided.

Habits of Formica rufa.—Mr. McCook, speaking of the habits of *Formica rufa*, stated that the ants descending the tree-paths, with abdomens swollen with honey-dew (called by him *Repletes*), were arrested at the foot of the trees by workers from the hill seeking food. Galleries communicating with the hill, opened at these points, around and in which numbers of ants were huddled engaged in drawing or bestowing rations of honey-dew. Similar commissary stations were found under the stones near by. The replete reared upon her hind legs, and placed her mouth to the mouth of the pensioner, who assumed the same rampant posture. Frequently two, sometimes three pensioners were thus fed at once by one replete. Apparently the workers engaged in building at the hill and galleries

had thus resorted to these feeding places to obtain ordinary food, in the same manner that queens, males, and young ants receive it, viz., by disgorgement from the abdomens of repletes. The latter commonly yielded the honey-dew complacently, but sometimes were seized and arrested by the pensioners, occasionally with great vigor.

A number of experiments were described leading to the conclusion that there was complete amity between the ants of a large portion of the field, embracing some 1600 hills and countless millions of creatures. Insects from hills widely separated always fraternized completely when transferred. A number of ants collected from various hills fraternized in an artificial nest, harmoniously building galleries and caring for the cocoons.

It was found that ants immersed in water when replaced upon the hills were invariably attacked as enemies; the assailants, being immersed, were themselves in turn assaulted. A number of experiments were made which indicated that the bath had temporarily destroyed the peculiar odor or other property by which the insects recognized their fellows.

The variety of *F. rufa* which had colonized in vast numbers on the cliff at Rockland opposite the steamboat landing, as observed for the last three summers, were found that morning to have abandoned the place. No trace of them could be seen in the vicinity. The crowds of human beings who occupied the spot during the late International regatta had evidently dispersed the republic.

OCTOBER 17.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

A paper entitled "Descriptions of some Vertebrate Remains from the Fort Union Beds of Montana," by Edward D. Cope, was presented for publication.

OCTOBER 24.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

On Webs of New Species of Spiders.—Mr. McCOOK called attention to several new species of spiders, with the view to illustrate the existence of mixed habits in construction of the web. The first of the two great groups of the Araneæ, viz., the

Sedentary Spiders, consists of the four sub-orders, (1) orb-weavers (*Orbitelariæ*), (2) line-weavers (*Retitelariæ*), (3) tube-weavers (*Tubitelariæ*), and (4) tunnel-weavers (*Territelariæ*). The first web, that of *Epeira triaranea*, n. sp., exhibits quite distinctly the characteristics of the first three of the above sub-orders. The orb, which is the primary characteristic of the snare of this arachnid, is partially inclosed by a web having quite as distinctly the characteristics of the line-weavers. This secondary snare extends several inches above the orb. At the top is a tertiary snare characteristic of the third sub-order. It is a mortar-shaped tube, of white, close textured silk, opening downward. Within this the spider dwells, clasping with its fore-claws a thick thread or free radius which is attached to the centre of the orb. He had not been able to determine whether the secondary snare is used, as with the line-weavers, in taking prey, or is possibly a simple protection against hymenopterous enemies. The tube or tent is quite frequent in connection with the orb-weaver's snare, but the mixture of the line-weaver's habit is rare, having been observed in but one other Epeiroid, *Epeira labyrinthea* of Hentz, the architecture of which was described. A possible exception was noted in the web of *Argiope fasciata*, one of the most beautiful and interesting of our indigenous spiders. In three instances the orb-shaped web of *A. fasciata* was found protected on either side by a cone-shaped mass of right lines. In all other webs of the same species observed, this mixed habit was not indicated. Possibly it may be in the course of development. It was suggested that the use of this auxiliary web might be to protect the snare from destruction, or to save the animal from enemies. A like tendency to mixed webs was observed in a new species of tube-weaver named provisionally *Tegenaria phiioteichos*. It is found in vast numbers upon the brick walls and fences of our city. Its web shows distinctly the characteristics of the orb-weaver's snare in the radial lines issuing from the opening or openings of the central tube. These lines are overlaid upon each other, and with the adhering street dust, present the appearance of rude lace-work. The outside of the wall seems curiously to be preferred. The apparent affinity of this spider to *Ergatis benigna* of Europe, and *Theridion morologum* Hentz, was shown by photograph and description. The latter named spider much resembles *T. philoteichos* in appearance, although uniformly of a far lighter hue. Its web, cocoon, and general habits greatly differ. The one appears to be a creature of the city, the other of the fields.

OCTOBER 31.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-five members present.

A paper entitled "Descriptions of Vertebrate Remains chiefly from the Ashley Phosphate Beds of North Carolina," by Jos. Leidy, M.D., was presented for publication.

Self-fertilization in Mentzelia ornata.—Mr. THOMAS MEEHAN referred to an objection made during his remarks on this plant some weeks ago, that a flower which had produced a perfect capsule under a gauze bag to exclude insects, might yet not produce perfect seeds. The capsule was now ripe, and the seed perfect.

Direct Growth Force in Roots.—Mr. MEEHAN spoke of the direct growth-force in roots, as illustrated by some specimens of the White Hickory (*Carya tomentosa*) exhibited. The Hickories during the first few years of their growth developed far more beneath than above the surface. He had seen Pecan Nuts (*Carya olivæformis*), with weak stems not two feet high, have tap roots six feet long. In the one year hickory now exhibited, the tap root was three times the length of the stem. In one plant, however, the young radicle, instead of pushing through the cleft made by the separated shell, had been directed into the shell, and in its fruitless effort to penetrate the wall, had lingered so long, that the upper portion had grown so large as to prevent egress. The root, therefore, instead of making a slender growth of eighteen inches long, had simply made a bulb of about three quarters of an inch in diameter with the shell of the nut attached to it.

Interpretation of varying Forms.—Mr. THOS. MEEHAN said that William Bartram, in the last century, had found forms of *Liriodendron tulipifera* on the Schuylkill River, as he had been informed by his son-in-law, with entire leaves, but only this year had he succeeded in discovering them. Some of these leaves he exhibited. He observed that years ago, such discoveries had an interest in themselves. Now the botanist expected to find entire leaved forms among kinds usually lobed, or lobed ones among the entire leaved class; the only value now in these discoveries is in any lesson they might teach. As a rule, he hesitated to refer to the unpublished observations of others, preferring that the discoverers should in their own good time and way, report what they had found; but hoped to be pardoned on this occasion, for saying that on a recent visit to the Academy, the distinguished botanist Dr. Engel-

mann had pointed out that some oaks had lobed leaves even in early infancy, while others had entire leaves, but that those which had the early lobed leaves assumed more entire leaves when mature, and those which had entire leaves when young, had lobed leaves when fully grown. In many oaks which he had examined he found Dr. Engelmann's observation correct, and that it extended to many other plants. The mulberries generally had lobed leaves in their younger years, but when mature the leaves were uniformly entire; and this was especially well known in the case of the *Broussonetia*. In young Japan Honeysuckles the leaves were quercifform or variously lobed, while at maturity the tendency to union was often remarkable. In the common ivy the halbert-shaped leaves of youth, always gave place to lobeless forms when of fruiting age. But it was in cruciferous plants that the differences were best seen. Here lyrate or pinnatifid leaves in infancy often gave place to entire ones as the plant grew, while there were numberless instances in which entire juvenescent leaves gave place to pinnatifid ones in adolescence. However, the point for the present evening was, that there was often a vast difference between the leaves of a plant's early life, and their form in advanced age. In Coniferæ he said this was well known. During the first few months from seed, the different species in their several subdivisions were so nearly alike, that it was almost impossible to tell any one apart till a little age had brought divergence from the original type. He exhibited some young Thujas to illustrate this. The early Thujas all had ericoid leaves. In the forms which we knew as Arbor Vitæs, the condition which we were familiar with was the secondary form. In these the leaves, which in juvenescence were free and heath-like, had become almost wholly united with the branches. But there were cases where the young Arbor Vitæs had never had power to leave their early condition. They were the analogues of what we know in human nature as imbeciles or feeble minded; and of this class were many so-called "*Retinesporas*," *Biota Meldensis*, and many Junipers and Thujas. He had known the *Thuja ericoides* of gardens remain fifteen years in this infantile state, and then only one of thousands to regain the pure adolescent or fan-like arbor vitæ form. In all these cases it is important to notice that a comparative feebleness of growth, and an absence more or less total of all disposition to produce flowers, go with these continuously juvenescent characters. With the appearance of sexual characters, there is a change of form; and, in proportion as this change is the more marked, is the relative productiveness. The White Oak (*Quercus alba*) which, during its first year, has entire leaves, has them lobed at maturity; and the trees which have them the most deeply lobed are the most productive in acorns.

He found these observations to hold good in the entire leaved *Liriodendron*. During the first year all tulip trees had entire

leaves, or at least more or less so in comparison with those which they afterwards assume. These large trees with entire leaves had merely retained their juvenescent form. The other attendant characters of juvenescence were also present. The tree from which the large entire leaf exhibited was taken had no signs of ever having borne seeds. In one place he found two trees which, from surrounding circumstances, he should judge were probably about the same age, and in every circumstance relating to nutrition equally favored, one with very deeply cut leaves even to the most feeble branch was covered with seed cones, and was thirteen feet in circumference. The other had leaves almost entire, with but few fruit, and a trunk of only eight feet round.

The danger was that in discussing laws of variation in connection with the origin of species we may overlook these sexual and physiological changes. If one never having seen a Baltimore oriole should notice particularly the brilliant plumage of the male bird, and, without noticing the sex, compare it with the very different looking female bird, he would be very apt to think he had found a "missing link" in a grand evolutionary chain. There were many differences in animals which were recognized as having their origin in obscure sexual laws, as well as many more unrecognized but probable; and he believed these cases were far more numerous in vegetation, and they would have to be carefully eliminated from consideration in any study on the origin of species or the evolution of form in relation thereto.

Edwin A. Barber, H. F. Whitman, and Dr. W. Forwood, U. S. A., were elected members.

Col. W. L. Ludlow was elected a correspondent.

The following papers were ordered to be printed:—

ON THE MARINE FAUNAL REGIONS OF THE NORTH PACIFIC; AN INTRODUCTORY NOTE TO THE REPORT ON ALASKAN HYDROIDS, BY MR. CLARK.

BY W. H. DALL, U. S. COAST SURVEY.

Mr. Clark's paper is the first of what is hoped will form a series, by different specialists, on the collections of marine invertebrates, obtained by me, with the co-operation of my party and other persons interested, during a period extending over nearly ten years. The first explorations in that region were begun in 1865, under the direction of the late lamented Robert Kennicott, and by the courteous co-operation of the officers of the Western Union Telegraph Company. Since the death of Mr. Kennicott the direction of the work has devolved upon me. By far the richest portion of the invertebrate collections has been obtained between 1871 and 1875, while engaged on hydrographic work for the U. S. Coast Survey. During the whole period mentioned the work has been aided by the earnest co-operation of the Smithsonian Institution, a circumstance to which is due a large part of our success.

Among those persons to whom we owe thanks for assistance in forming the collections, and to whom I beg to express my sense of indebtedness, are particularly to be mentioned Capt. E. E. Smith, of San Francisco, whose energetic dredgings in the Arctic Ocean have furnished nearly all our material from that region; Mr. Bernhard Bendel, formerly stationed at Unalashka; and Messrs. W. G. Hall, E. P. Herendeen, A. R. Hodgkins, Sylvanus Bailey, Mark W. Harrington, Marcus Baker, and Wm. M. Noyes, attached for shorter or longer periods to the Coast Survey party under my charge. To the officers directing the U. S. Coast Survey I have been indebted for hearty co-operation.

In April, 1873, I gave a short notice of the principal faunal regions into which the information gained in the field seemed to permit the division of the coast of Alaska. Mr. Clark's independent reasoning from a study of the hydroids alone, confirms in every particular the opinions then expressed, and information gained since 1873, seems to offer only additional confirmation of the views held by me at that time, with some interesting additions.

A brief statement of these views will be in place here.

The coast of Alaska and northwest America from Monterey, California, north and west may be divided into three faunæ.

I. *The Oregonian Fauna.*

This extends from Monterey to the Shumagin Islands.

II. *The Aleutian Fauna.*

The range of this province is from the Shumagins westward throughout the Aleutian chain, and northward to the winter line of floating ice in Bering Sea; a line extending westward from Cape Newenham toward and grazing the Pribiloff group, and thence to the western termination of the Aleutian chain, bounded by the depth of the water in Bering Sea, extending probably to no greater depth than five hundred fathoms, and entirely cut off from the adjacent coasts of Asia.

III. *The Arctic Fauna.*

This well-recognized fauna passes in water over five hundred fathoms in depth indefinitely southward on the ocean bottom. By the shores it is limited by the winter line of floating ice, or water of the temperature of thirty-two Fahrenheit at the surface, for a certain proportion of the year.

The species belonging to this fauna creep southward along the shores to the northernmost islands of Japan on the west coast and Cape Newenham on the east coast of the ocean of this region. Many of them extend even further south; as the species of Arctic habitat have a greater facility of adaptation to other than their normal conditions than those of any other existing fauna.

The material derived from the coasts of N. W. America, from Cook's Inlet south and east, indicate a series of Arctic colonies in favored localities, the future exploration of which offers a labor of the highest interest. These colonies are situated where the depth of water, the drippings of glaciers, and the high and adjacent shores of the Great Archipelago, combine to reduce the temperature of the water below its apparently normal isotherm. Cook's Inlet affords one of them, one exists in the Gulf of Georgia, and others only await further exploration.

In these colonies we find strictly Arctic species, such as normally abound in the vicinity of Icy Cape; islands of polar life surrounded by shoaler water; forms altogether alien to them. In the absence of information as to depth and temperatures, collections made at such localities would indicate to the student only inextricable confusion of different faunæ.

The species of each fauna are not, of course, rigidly bound

within the limits above set forth. According to their various degrees of adaptability to the surroundings, they creep south or north from their own proper region, until their limit of temperature is reached.

Nevertheless the course of currents, the changes in depth and the variation in temperature, are so far co ordinate that the limits herein mentioned may be taken as approximately exact for the mass of species.

I would here reiterate the view published by me in 1868, that temperature, and temperature alone, is the great factor in determining the limits of marine faunæ. Depth, salinity, specific gravity, motion or quietness in the water, and geological character of the shores and sea bottom have their influence in determining the distribution and individual characters of particular species or small groups of species; but for marine faunæ, all my field observations lead to but one conclusion, that they are absolutely dependent on the water temperatures. It is hardly necessary to point out, in view of recent deep sea researches, that the ocean valleys which so sharply separate adjacent faunæ, are in such cases valleys of depressed temperature as well as depressed sea-bottom. Leaving out strictly littoral or shore forms, restricted by the nature of their food to very moderate depths, no case is known to me in which a deep sea valley, not containing colder water than that on either side of it, separates two great marine faunal provinces. Local subfaunæ are not here considered.

The geological formation supplies the elements of plant life; the phytophagous mollusks are distributed where they can obtain their favorite food. All formations supply some algæ, and the zoöphagous mollusks can find some food almost anywhere. They are therefore the best indices of faunal provinces in their own subkingdom. Something similar is probably true of other groups of marine animals. The mollusks are here referred to as the group with which I have the greatest familiarity. A striking instance of this local distribution is afforded by granitic areas. On the Alaskan coast these appear to afford special opportunities for the growth of the red or chlorospermous algæ. In granitic districts they are quite abundant compared with what we know of their occurrence in sandstone or basaltic regions. Here also we find a number of species which prefer red algæ as food, and a notable tendency to rosiness in the coloring of shells and annelids.

Other details of a similar nature are reserved for future publication.

In regard to the collection of hydroids it may be remarked that the collection illustrating the Arctic province was very small, and by no means sufficient to represent it fairly.

The Oregonian province is also less fully represented than is desirable. For the Aleutian region the collection is tolerably full, though it cannot be doubted that many of the more minute or delicate forms were overlooked. However, Mr. Clark's paper forms a desirable contribution to our knowledge of a little known region, and must be regarded as a considerable advance on our previous information. It is to be expected that a fuller investigation of the Arctic province will reveal many more circumpolar species, and in the Oregonian fauna a fuller representation of those already known from the Californian coast.

The types of the species mentioned are deposited in the National Museum in charge of the Smithsonian Institution at Washington; a series has also been placed in the Peabody Museum of Yale College, and in the Museum of the University of Michigan.

REPORT ON THE HYDROIDS COLLECTED ON THE COAST OF ALASKA AND THE ALEUTIAN ISLANDS, BY W. H. DALL, U. S. COAST SURVEY, AND PARTY, FROM 1871 TO 1874 INCLUSIVE.

BY S. F. CLARK, YALE COLLEGE, NEW HAVEN.

The Hydroids collected on the Alaskan coast by Mr. Dall, represent the fauna more or less completely from the Sea Horse Islands southwest of Point Barrow in latitude about 71° north, to Kyska Harbor 52° north, and from St. Paul Island, Pribiloff group, longitude 170° west, and Kyska Harbor 182° west to Sitka in longitude 135° west. This region includes a coast line of about 4000 miles naturally divided into three great divisions. The Arctic region, extending from Point Barrow to Cape Prince of Wales, washed by the Arctic Ocean; the western region, including all of the western coast of Alaska from Cape Prince of Wales to the Aleutian Islands, borders on Bering Sea, and the southern region, extending from the Aleutian Islands to Sitka, washed by the North Pacific. As the northern region is only represented by two species, one from the Sea Horse Islands and Cape Prince of Wales, and one from Icy Cape, we have no opportunity of comparing the Hydroid-fauna of that region with those of the other two. The region most abundantly represented in the collection is the southern, and it is here also that we find the most strongly marked fauna; for of the forty-two species in the collection, twenty-four are from the southern coast east of the Shumagin Islands, and of these twenty-four, fourteen are peculiar to this southern region. From the shores of the Aleutian Islands, from Unimak to Kyska, there are fifteen species represented, six of which are not found elsewhere, and four are found both to the northward in Bering Sea, and to the eastward in the Northern Pacific. The collections from these two regions (the Aleutian Islands, and the southern Alaskan coast, from the Shumagin Islands east to Sitka) contain thirty species, or fully three-fourths of the known species from Alaska. While this result is in part due to the fact that the greater amount of collecting has been done in these regions, it also indicates a richer fauna, for some important genera of the southern fauna are not represented north of the Aleutian Islands.

The most strongly marked barrier on the coast, as indicated by

the hydroids, is the Shumagin Islands on the southern shore, which is apparently the dividing line between the northern and southern forms. As in all the divisions of nature, there is, of course, no sharp line of demarcation, but a number of the species of each group have a range extending into the region of the other.

Of the forty-two species represented, sixteen have been recorded from the English coast, and of this latter number, all but two are found on the shores of New England; of the remaining twenty-six, one is identical with a New England form and the rest are new. The great majority belong to the group *Thecaphora* of Hincks, there being but four representatives of the *Athecata*.

The following table contains a list of all the Hydroids in the collection, and gives their range upon the Alaskan coast:—

THECAPHORA.

Obelia longissima Hincks (Pallas).	Iliuliuk Harbor, Unalashka.
Clytia Johnstoni Hincks (Alder).	Lituya Bay to Popoff Straits.
Campanularia denticulata, sp. nov.	Port Etches.
" circula, sp. nov.	Port Etches.
" turgida, sp. nov.	Port Etches.
" compressa, sp. nov.	Shumagin Islands.
" speciosus, sp. nov.	Shumagin Islands.
" urceolata, sp. nov.	Lituya Bay.
" integra Macgillivray.	Lituya Bay to Semidi Islands.
Gonothyrea hyalina Hincks.	Semidi Islands to Nunivak Island.
Lafoëa pocillum ? Hincks.	Nunivak Island.
" gracillima Sars.	Sitka Harbor to Shumagin Islands.
" dumosa Sars.	Port Etches.
" fruticosa Sars.	Shumagin Islands to Kyska Island.
Calycella syringa Hincks (Linn.).	Shumagin Islands.
Coppinia arcta Hincks (Dalyell).	Shumagin Islands.
Halecium muricatum Johnst.	Unalashka.
" ? plumularioides, sp. nov.	Nunivak Island.
" scutum, sp. nov.	Semidi Islands to Unalashka.
Diphasia mirabilis Verrill.	Port Möller to Shumagin Islands.
Sertularia filicula E. and S.	Shumagin Islands to St. Paul Island.
" similis, sp. nov.	Hagmeister Island.
" cupressoides, sp. nov.	Shumagin Islands to Hagmeister Id.
" variabilis, sp. nov.	San Miguel Id., Cal., to Nunivak Id.
" inconstans, sp. nov.	Unalashka.
" thuiarioides, sp. nov.	Chignik Bay to Nunivak Island.
Sertularella tricuspidata Hincks.	Port Etches to Kyska Harbor.
" rugosa Gray (Linn.).	Shumagin Islands to Nunivak Island.
" polyzonias Gray.	Port Etches to Nunivak Island.

Sertularella robusta, sp. nov.	Shumagin Islands.
" pinnata, sp. nov.	Lituya Bay to Unalashka.
Thuiaria cylindrica, sp. nov.	Port Möller to Hagmeister Island.
" robusta, sp. nov.	Hagmeister Island to Seahorse Ids.
" plumosa, sp. nov.	Nunivak Id. to Icy Cape, Arctic Sea.
" turgida, sp. nov.	Lituya Bay to Kyska Island and Hagmeister Island.
" gigantea, sp. nov.	Kyska Island to Hagmeister Island.
Lictorhynchia Dallii, sp. nov.	Akutan Pass.

ATHECATA.

Rhizocorma carnea, sp. nov.	St. Michael's, Norton Sound.
Tubularia indivisa (Linn.).	St. Michael's.
Tubularia borealis, sp. nov.	Hagmeister Island.
Eudendrium pygmæum, sp. nov.	Akutan Pass.

It is interesting to note that of the ten species of *Campanularidæ* represented, one only occurs to the northward of the Aleutian Islands; and as this one, viz. *Gonothyrea hyalina*, is recorded by Hincks from the Shetland Islands, by Sars from Lofoten, and by Professor Verrill from Eastport and St. George's Bank, it is apparently a northern or cold-water form. Both the species from the Arctic Sea belong to the genus *Thuiaria*, and of the five species of this genus in the collection, but one of them occurs south of Bering Sea. The genus is essentially a northern cold-water one. Hincks says of *T. thuia*, "it is a prevalent northern form, ranging to the North Cape," and Allman describes some species from very deep water, that were taken on the Porcupine expedition. The thickness of the perisarc seems to protect them from the dangers incident to living in cold deep waters.

A very noticeable feature, and a very general one, is the remarkable stoutness and large size of the specimens, especially in the *Sertularidæ*.

The main points of interest then derived from the study of the collection are—the strong indication of a faunal limit at the Shumagin Islands; the Hydroid-fauna to the south of that point being chiefly characterized by the large number of *Campanularidæ*, while the fauna to the northward is almost entirely destitute of that family and contains a larger number of *Thuiariæ*; the luxuriant growth and the robustness of nearly every species; the specimens of those species that are also found upon the New England shores being of larger size and stouter form than the eastern

specimens; thirdly, that while the fauna is quite distinct, as is indicated by the twenty-three new species, it has yet some similarities with the New England and British faunæ, which are shown in the fifteen species that are common to those three regions; fourthly, the small number of Athecata, which may be partly accounted for by the possibility of their having been overlooked, owing to the small size and obscure places of growth common to so many of the species of this group. And, lastly, the small number of species that are common to the Alaskan coast and the western shores of the United States from Vancouver Island southward. Of the twenty-three species recorded from the latter region one only, *Lafoëa dumosa*, is known from the coast of Alaska.

Descriptions of the Species.

THECAPHORA.

Obelia longissima, Hincks (Pallas).

This species is the most abundant member of the family in the collection, but, although some of the specimens are 150 mm. in length, and have a very luxuriant growth, a diligent search has failed to reveal any gonangia. It is possible that these forms may prove to be different from *O. longissima*, but the trophosomes agree so closely in every particular, that I think it quite safe to credit them to this species.

Hab. Iliuliuk, Unalashka; 3 fathoms, shingly bottom. Unalashka; 6 fathoms, November 11th, among sticks and beach-refuse, washed along the bottom. Unalashka; 80 fathoms, sand, and shells. Unalashka; 9 to 15 fathoms, September 10th. Unalashka; 15 fathoms, gray sand.

Clytia Johnstoni ? Hincks (Alder). Plate ix., fig. 12.

The collection contains specimens of a creeping campanularian from three localities which I have decided to call *C. Johnstoni*, for the present, at least. The gonangia are not present upon any of the specimens, and when known will enable us to decide whether these trophosomes have been placed in the right genus. The specimens from Lituya Bay correspond very closely with the New England forms of this species, while those from the other localities are more deeply campanulate, and some of them are much less tapering; the pedicels vary greatly in length and in the amount

of annulation which they bear. The character of the denticulation varies but little, if any, and the hydrothecæ, which show the greatest variation in size and shape, are connected by intermediate forms.

Hab. Lituya Bay; 9 fathoms, sandy-mud. Port Etches; 5 to 8 fathoms, gravel and stones, May 30th. Shumagin Islands, Popoff Straits; 6 fathoms, rocky, July.

Campanularia denticulata, sp. nov. Plate vii., fig. 4.

Trophosome. Hydrocaulus simple, creeping, giving origin to the pedicels at irregular intervals; pedicels of very variable length, from five to ten annulations at the base, and from three to eight at the base of the hydrothecæ, usually bearing but one hydrotheca, occasionally branched and bearing two. Hydrothecæ deeply campanulate, tapering from the distal end, quite slender near the base, rim ornamented with about fifteen large, acutely-pointed teeth. *Gonosome.* Gonangia unknown.

Hab. Port Etches, Alaska; 10 to 18 fathoms, clayey mud.

Campanularia circula, sp. nov. Plate vii., fig. 3.

Trophosome. Hydrocaulus erect, compound, composed of a number of slender united tubes, unbranched. Hydrothecæ large, deeply campanulate, rounded at the base, rim ornamented with from ten to twelve large denticulations, some of which are square-cut, others have slightly rounded edges, and are very shallow; the pedicels supporting the hydrothecæ are long and slender, a single distinct annulation at the base of the hydrothecæ, the remainder of the pedicel more or less twisted, arranged in verticils of four to six pedicels, at regular intervals on the stem. *Gonosome.* Gonangia unknown.

Hab. Port Etches, Alaska; 12 to 18 fathoms, clayey mud.

This well-marked form is represented by a single small specimen, which, unfortunately, is destitute of gonangia. Its nearest ally is *C. verticillata*, Lamk, from which it may be distinguished by the size and form of the hydrothecæ, and by the ornamentation of the rim.

Campanularia turgida, sp. nov. Plate viii., fig. 8.

Trophosome. Hydrocaulus simple, creeping, giving rise, at short intervals, to long pedicels bearing the hydrothecæ. Hydrothecæ large, turgid, rounded at the base, the rim ornamented with from twelve to sixteen roundly pointed or sometimes square-

topped teeth, borne on long, slender pedicels with a wavy outline, or occasionally a slight twist in them, a single well-marked annulation at the base of each hydrotheca, and from three to six annulations at the base of each pedicel. *Gonosome.* Gonangia borne on short pedicels consisting of five or six annulations springing from the creeping stem, flask-shaped, largest in the middle, tapering but slightly to the rounded base, produced into a neck distally, aperture terminal, discoidal.

Hab. Port Etches, Alaska; 12 to 18 fathoms, mud.

Campanulari compressa, sp. nov. Plate viii., figs. 5, 6.

Trophosome. Hydrocaulus creeping, simple, giving origin to the pedicels at irregular intervals. Hydrothecæ large, deeply campanulate, tapering to the base, the walls very thick, especially at the base, where they project inwards, forming a sort of diaphragm, upon which the polyp rests, rim entire; pedicels of medium length, with a single well-marked annulation at the base of the hydrothecæ, and usually two or three constrictions just beneath the annulation, not annulated at the base. *Gonosome.* Gonangia turgid, sessile, or with a very short pedicel, largest at the distal end, rounded at the base, very much compressed laterally.

Hab. Yukon Harbor, Shumagin Islands; 6 to 20 fathoms, sand and rocks, July 7th. Growing on a piece of Laminaria.

This form belongs in the same group with *C. calyculata*, Hincks, from which it may be distinguished by the gonangia, and by the base of the hydrothecæ.

Campanularia speciosa, sp. nov. Plate ix., fig. 11.

Trophosome. Hydrocaulus simple, creeping, twisted, bearing the pedicels at irregular intervals; pedicels short, more or less annulated, bearing each a single hydrotheca. Hydrothecæ very large, deeply campanulate, urceolate, the rim ornamented with about ten shallow teeth, and with an internal ridge extending from each tooth for about one-fourth the distance, to the base of the hydrotheca. *Gonosome.* Gonangia unknown.

Hab. Yukon Harbor, Big Koniushi, Shumagin Islands; 6 to 20 fathoms, gravel, July 7th.

This is the largest creeping Campanularian known, and is as ble for its beauty as for its size. The intrathecal ridges aracter of the denticulations make it a well-marked

form, readily distinguishable, without the gonangia, from any known species on the American coast.

Campanularia urceolata, sp. nov. Plate viii., fig. 7.

Trophosome. Hydrocaulus simple, creeping, rather stout, with a wavy outline, giving origin to the pedicels at irregular intervals; pedicels short, never more than twice the length of the hydrothecæ, usually annulated or twisted throughout, and always one annulation at the base of each hydrotheca more distinctly marked than the rest. Hydrothecæ large, deep, urceolate, rounded or slightly tapering at the base, with an internal support in the base of the hydrotheca upon which the polyp rests, rim ornamented with from thirteen to eighteen large rounded teeth. *Gonosome.* Gonangia small, fusiform, occasionally a trifle obovate, orifice small, terminal, discoidal, supported on very short pedicels consisting of but two or three annulations.

Hab. Lituya Bay, Alaska; 9 fathoms, sandy mud.

Campanularia integra, Macgillivray. Plate ix., figs. 9, 10.

This species is represented by two fine specimens, which are in an excellent state of preservation, and have three or four fully developed gonangia. The latter are a little larger than usual.

Hab. Semidi Islands; 15 to 25 fathoms, gravel, June 10th. Lituya Bay; 9 fathoms, sandy mud.

The specimen from the Semidi Islands was growing upon a stem of *Sertularella tricuspidata.*

Gonothyrea hyalina, Hincks. Plate vii., figs. 1, 2.

This is apparently one of the most common species of the family *Campanulariidæ* on the Alaskan coast. Very good specimens were obtained from five different localities; those from the Semidi Islands being of especial value, as they bear extra-capsular medusoids at the distal ends of the gonangia. The medusoids vary in number from two to six, are slender and pyriform, which is probably, in part, owing to the contraction due to the alcohol.

Hab. Semidi Islands, Alaska; 15 to 25 fathoms, gravel, June 10th. Port Möller, Aliaska Peninsula; 13 fathoms, gravel; 17 fathoms, sand; August. Five miles southwest of the west cape of Nunivak Island; 30 fathoms, sand.

Lafoëa pedillum? Hincks. Plate xi., fig. 21.

There are two specimens of creeping forms of *Lafoëa* in the collection, to the examination of which I have given considerable

time. Number 1 has short, stout hydrothecæ of variable shape, borne upon short pedicels of from three to six annulations, the latter showing a good deal of difference in the stoutness, some being half as wide as the hydrothecæ, others not more than a third; most of the hydrothecæ are urceolate, like Hincks's figures of *L. pocillum;* others are regularly cylindrical, like Hincks's figure of *L. parvula*, and between these two are forms which make a connecting series between the urceolate and cylindrical types. Number 2 has the hydrothecæ of about the same width, but longer, the pedicels average a little longer, and it agrees more closely with *L. pocillum* than the more variable form of number 1. The perisarc of both these forms is very thick, and dark-brown colored.

Hab. Number 1 is from Cape Etolin, Nunivak Island, Alaska; 8 to 10 fathoms, stony. Number 2 is from Bering Sea, 5 miles west of west cape of Nunivak; 30 fathoms, sand.

Lafoëa gracillima, Sars. Plate xii., fig. 24.

Very fine specimens of this delicate form were collected, which show no variations from the specimens found on the eastern shores of North America. Gonangia unknown.

Hab. Coal Harbor, Shumagin Islands, beach; July 15th. Sitka Harbor; gravel and mud, 15 fathoms, May 1st.

Lafoëa dumosa, Sars. Plate xii., fig. 23.

This widely distributed species is also a member of the Alaskan Hydroid Fauna. The specimens are larger and more robust than those from the eastern shores of North America, and the hydrothecæ are more deeply merged in the stem. It is very singular that we are still obliged to record, for this common and widely distributed species, gonangia unknown.

Hab. Port Etches; 12 to 18 fathoms, clayey mud.

Lafoëa fruticosa, Sars. Plate xii., fig. 22.

This appears to be the most common of the four species of this genus in the collection. It differs only from the New England specimens in being more robust. Gonangia unknown.

Hab. Kyska Harbor; 10 fathoms, rocky, July 15th. Popoff Straits, Shumagin Islands; near edge of reef, 6 fathoms. Yukon Harbor, Big Koniushi, Shumagin Islands; 6 to 20 fathoms, sand and rocks, July 7th.

Calycella syringa, Hincks (Linn.). Plate xii., fig. 25.

A very fine specimen of this species occurs on a colony of *Lafoëa gracillima*. It is in very fine condition, and has the gonangia with extracapsular pouches in considerable abundance.

Hab. Coal Harbor, Shumagin Islands; beach, July, about the 15th.

Coppinia arcta, Hincks (Dalyell).

A very fine specimen of this peculiar form was collected at the Shumagin Islands. The hydrothecæ are very long, and most of them curved near the distal end. Growing on the stem of a colony of *Lafoëa gracillima*. The largest hydrothecæ are 2 mm. long.

Hab. Coal Harbor, Shumagin Islands; beach, July 15th.

Halecium muricatum, Johnston (E. and S.). Plate x., fig. 15.

A single specimen of this species with the characteristic gonangia, was collected on Unalashka beach. The trophosome is about 50 mm. in height, but is in very poor condition, none of the hydrothecæ being present. The gonangia, however, are very abundant, are irregularly arranged on the basal half of the compound stem, and are in a good state of preservation.

Halecium (?) plumularioides, sp. nov. Plate x., figs. 16, 17.

Trophosome. Hydrocaulus erect, simple, straight, divided by transverse joints into internodes of considerable length, regularly branched, and with a few annulations at the base; branches arranged alternately on opposite sides of the stem, one to each internode, having their origin in a small shoulder-like process just below each joint, divided usually into regular internodes, though, in some cases, short internodes occur between the longer ones. Hydrothecæ arranged uniserially, usually one to each internode, partly adherent to the stem, or entirely free, shallow, tapering slightly to the base, with an entire rim.

Gonosome. Gonangia unknown.

Hab. Cape Etolin, Nunivak Island; 8 to 10 fathoms.

Height of largest specimen 20 mm.

I refer this species to the genus *Halecium* provisionally, for, the gonangia being absent, and the hydrothecæ having a different arrangement from any known *Halecium*, make it quite doubtful whether it belongs in this genus. It is the most delicate species in the collection. It closely resembles, in many particulars, the

Plumulariæ, from which it is separated on account of the absence of nematophores.

Halecium scutum, sp. nov. Plate x., figs. 13, 14.

Trophosome. Hydrocaulus erect, compound, exceedingly stout, rough, with an irregular outline, attached by a thick mass of interlaced stolons, much and irregularly branched; branches of two kinds, the larger ones stout, black, and like the main stem undivided by joints, the smaller are light horn-color, sub-erect, short, divided into long internodes, each giving origin to a single branchlet; branchlets divided by oblique joints into short, stout, wedge-shaped internodes, each of which bears at least one hydrotheca, often two. Hydrothecæ tubular, margin everted, arranged alternately, and occasionally a second one is borne in the axil of the first. *Gonosome.* Gonangia very large, obovate, with the orifice on one side; the latter varies much in position, occurring anywhere from the middle to near the distal end; it has an irregular outline, and is made very ornamental by the thickening of the perisarc around it; there is a thickened border around the upper edge, and below the orifice is a shield-shaped thickening in which are two ellipsoidal markings, where the chitin is only of the usual thickness.

Height of largest specimen 150 mm.

Hab. Unalashka; beach, low water, after gale, September. Coal Harbor, Shumagin Islands; low water, April; Gonangia abundant. Coal Harbor, Shumagin Islands; Gonangia abundant. Unalashka; beach, May 1st; Gonangia abundant. Semidi Islands, Alaska; 15 to 25 fathoms, gravel, June 10; Gonangia. Sanborn Harbor, Shumagin Islands; Gonangia abundant

The specimen from which the above description is taken is a remarkably stout, coarse form, more closely resembling Hinck's figure of *Eudendrium rameum*, Pallas (*vide* frontispiece to Hinck's *British Hydroid Zoöphytes*, vol. i.), than any hydroid that I am acquainted with. The diameter of the mass of stolons at the base is from 15 mm. to 25 mm. The largest stem is 6 mm. thick at the base, and tapers very gradually to the distal end.

The variation which this species shows in the mode of growth is so remarkable that I will mention some of the most divergent forms. The specimens from Sanborn Harbor, Shumagin Islands, consist of tufts of light horn-colored stems about 50 mm. in height, rather slender and compound only for a very short dis-

tance at the base, branches very short. Gonangia present, and exactly like those of the typical form. Another style is from 20 mm. to 60 mm. high, from dark horn-color to black, stem stout, coarse, branches numerous and short. Gonangia very abundant; has a crowded look; specimens of this form are from Unalashka; beach. Semidi Islands; 15 to 25 fathoms, gravel. Coal Harbor, Shumagin Islands; beach, low water, after a gale in September.

Diphasia mirabilis, Verrill. Plate xiii., fig. 36.

American Journal of Science, iii., vol. v. p. 9, December, 1872.

Connecticut Academy of Arts and Sciences, vol. iii., Part I., p. 53.

Two specimens of this remarkable form are the only representatives of this genus in the collection. The specimens are in very good condition, and show no variation from Professor Verrill's type specimen from Le Have Bank, with which I have compared them. Gonangia unknown.

Hab. Hagmeister Island, Bering Sea; beach. Popoff Straits, Shumagin Islands.

Sertularia filicula, E. and S. Plate xii., fig. 30.

This species grows very luxuriantly, and is apparently quite common on the beaches. There is a good supply of it in the collection, mostly from Unalashka beach. It grows there in very dense masses from 50 to 80 mm. in height, is usually of a dark horn-color, and attached to algæ or sponge. The gonangia vary somewhat from the figure given by Hincks, but not enough to warrant a separation of this form from the British. The Alaskan form has the gonangia sessile, largest at the distal end, tapering to the base, aperture terminal, small, discoidal. In the British form they are more fusiform or are pear-shaped, largest near the middle, with a short tubular aperture. The trophosomes agree perfectly.

Hab. Unalashka; beach after gale, September. Coal Harbor; Popoff Straits, Shumagin Islands. St. Paul Island (Pribiloff group); 9 fathoms, sand, July 24. Hagmeister Island; beach. San Miguel Island, California. Nunivak Island; 8 to 10 fathoms. Constantine Harbor, Amchitka Island; 6 to 10 fathoms, sand and stones, July 20. Chirikoff Island; beach.

Sertularia similis, sp. nov. Plate xv., fig. 56.

Trophosome. Hydrocaulus erect, simple, slender, straight, jointed, pinnately branched, internodes of equal length and bear-

ing three hydrothecæ and a branch; branches short, slender, divided by transverse joints into short internodes, bearing two, sometimes three pairs of hydrothecæ, occasionally bearing one or two branchlets, constricted at the base; branchlets jointed like the branches, and like them constricted at the base, diverging at a wide angle from the branches. Hydrothecæ opposite, tubular, curved strongly outwards with a bilabiate orifice, the broad side being turned towards the stem; on the main stem there are three on each internode, a pair placed opposite to each other, and one in the axil of the branch; on the branches and branchlets they are arranged oppositely. *Gonosome.* Gonangia unknown.

Height of largest specimen, 85 mm.

Hab. Hagmeister Island; 8 to 15 fathoms, gravel.

This is a very interesting species, as it combines some of the characters of three other species of the genus. In mode of growth it approaches *S. cupressina*, in the shape of the hydrothecæ it is similar to *S. argentea*, and in the arrangement of the latter it is like *S. pumila*. Considerable variation is shown in the extent to which the hydrothecæ curve outwards; upon some of the branches the mouth opens at right angles to the stem, while upon others they open upwards.

Sertularia cupressoides, sp. nov. Plate xiii., fig. 37.

Trophosome. Hydrocaulus simple, erect, slender, two or three annulations at the base, divided by oblique joints into internodes of variable length, pinnately branched; branches arranged alternately, an even number to an internode, attached to the stem by quite a prominent process, annulated and slender at the base, the broader side facing the stem; the basal portion is sharply curved outward, the distal portion is nearly straight, and lies about at right angles with the stem, bearing but very few branchlets; branchlets short and diverging at a wide angle from the branches. Hydrothecæ tubular, deeply immersed in the stem, curving slightly outwards; orifice bilabiate, with the broader side facing the stem, arranged sub-alternately upon the branches and branchlets, none upon the main stem. *Gonosome.* Gonangia unknown.

Height of finest specimen, 80 mm.

Hab. Shumagin Islands, Popoff Straits; 6 fathoms, rocky bottom. Port Möller, Aliaska Peninsula; 13 fathoms, sand,

This species is quite similar to *S. cupressina* in some respects, but may be distinguished by the entire absence of hydrothecæ upon the main stem, and by having an even number of branches to an internode; the branches are also usually stouter.

Sertularia variabilis, sp. nov. Plate xiv., figs. 40 to 48. Plate xv., figs. 49, 50.

Trophosome. Hydrocaulus erect, simple, stout, flexuous, divided by transverse joints into short internodes, usually bearing a pair of hydrothecæ, those giving origin to a branch bearing one hydrotheca on one side and two hydrothecæ and the branch on the other, regularly branched; branches arranged alternately on opposite sides of the stem, short, stout, suberect, occasionally bearing a few short branchlets; the latter usually divided into regular internodes, bearing each a pair of hydrothecæ, sometimes occurring undivided. Hydrothecæ large, subalternate, the widest portion, the lower two-thirds, is immersed in the stem, the upper portion is narrower and curved strongly outwards and upwards; aperture large, discoidal, rim entire. *Gonosome.* Gonangia of two forms; No. 1 is pyriform, tapering rapidly to the base, sessile; orifice large, terminal, discoidal, ornamented with a number of chitinous teeth which project downwards into the gonangia; No. 2 is obovate, sessile, aperture terminal, large, provided with an internal collar, the latter ornamented with a number of acute teeth, which project downwards; borne in two rows on the upper sides of the branches.

Height of largest specimen, 100 mm.

Hab. Unalashka; beach. Lituya Bay; 112 fathoms. Hagmeister Island, Bering Sea. Sanborn Harbor, Shumagin Islands; beach. Captain's Harbor, Unalashka; 60 to 80 fathoms, sand, September 13. Port Etches, Alaska; 12 to 18 fathoms, clayey-mud. Five miles southwest of the west cape of Nunivak, Bering Sea; 30 fathoms sand. Popoff Straits. Semidi Islands; 15 to 28 fathoms, gravel, June 10. Unalashka; 6 fathoms, Nov. 11th. St. Paul Island, Pribiloff group; 9 fathoms, sand, Kelp ground, July 24th. Akutan Pass, near Unalashka; beach. Big Koniushi, Shumagin Islands; 6 to 20 fathoms, sand and rocks in Yukon Harbor, July 7th. San Miguel Island, California; W. H. Dall.

This is the most variable form of hydroid that I am acquainted with. Besides the great variation which is shown within the ordinary limits of specific differences, there are two extreme forms which, without as complete a series of connecting forms as there

is in Mr. Dall's collection, would undoubtedly be called distinct species. One of these two varieties is represented by only two specimens, one of which is somewhat worn and mutilated, while the other is in good condition, and bears a number of gonangia. This variety is much more robust than any of the normal forms, the branches being an eighth of an inch wide; the hydrothecæ are very large and swollen in the middle portion; the gonangia are of the kind given as No. 2 in the description. The other variety has slender hydrothecæ which are free for more than half their length, are not swollen in the middle, and the outline from the aperture of the hydrotheca to the stem forms a curve which projects into the hydrotheca, while in the robust form it projects outward; most of the hydrothecæ also have a projection in the shape of a small horn at the inner, inferior angle; some of those on the distal ends of the branches have a well-defined notch in the rim, on the opposite side from the stem, forming a blunt tooth on each outer corner, and between each tooth and the inner margin of the rim there is a slight sinuosity. This character of the rim decreases towards the lower portion of the stems and branches to such an extent, that many of the hydrothecæ have a rim that is entire, or nearly so.

This is not only the most variable, but apparently the most abundant form on the Alaskan coast. In some of its variations it is quite similar to *S. abietina* of the New England shores, Greenland, and the North Cape, which also shows considerable specific variation.

Sertularia inconstans, sp. nov. Plate xv., figs. 51, 52.

Trophosome. Hydrocaulus erect, simple, constricted at the base, jointed obliquely, internodes of uniform size, densely branched; branches mostly short, arranged alternately, one to each internode, erect, lying close to each other, a few of the larger shoots bear one or two large branches similar to the main stem, divided by transverse joints into internodes of very variable length, constricted at the base, attached to the stem by quite a prominent process, but little branched; branchlets few, short, erect. Hydrothecæ large, swollen at base, a constriction near the distal end, aperture discoidal, rim entire, arranged alternately upon the branches and branchlets; on the lower part of the stem, below the branches, there are two to each internode; on the upper portion of the stem there are usually three to each internode, one on one side

and two on the other; one of the latter being in the axil of the branch.

Gonosome. Gonangia sessile, large, orifice terminal, small, discoidal; outline very irregular, tapering usually at the base; borne in two close-set rows on the distal portion of the main stem.

Height of specimen 45 mm.

Hab. Unalashka; beach.

From the character of the trophosome, this species evidently belongs in the same group with *S. abietina* and *S. filicula*, the hydrothecæ agreeing very well in form and arrangement. The mode of growth, however, is quite different, the number and closeness of the branches and branchlets giving to the colony a very dense, plumose appearance.

The gonangia show the greatest amount of variation of any species that I know of; it is impossible to describe their form, for there is not one of them which seems to agree with any other.

Sertularia thuiarioides, sp. nov. Plate xiii., figs. 38, 39.

Trophosome. Hydrocaulus erect, simple, very slender at the base, largest at the distal end, the middle portion slender and of uniform size, jointed transversely, internodes of variable length, regularly branched; branches sub-erect, short, springing from opposite sides of the stem, but spirally arranged owing to the stem being twisted, much branched, on some of the largest specimens two or three large branches occur, which resemble the main stem in every particular; branchlets short, spreading widely, bearing a few small subdivisions. Hydrothecæ tubular, deeply immersed, with a constriction on the inner side of the distal end, aperture semilunar shape, arranged alternately upon the branches and branchlets, and basal part of the stem; on the upper branched portion the internodes usually bear one hydrotheca on one side, and two hydrothecæ and a branch on the other.

Gonosome. Gonangia large, sessile, tapering at the base, ornamented with two pointed horns placed opposite to each other, near the distal end; aperture terminal, discoidal, ornamented with a row of teeth projecting into the gonotheca, borne in single rows on the upper sides of the branches and branchlets.

Height of largest specimen 180 mm.

Hab. Bering Sea, 5 miles west of the West Cape of Nunivak Id.; 24 fathoms, sand. Chignik Bay, Aliaska; 11 to 16 fathoms, sand.

I have not been able to make out any distinct opercula, but in

one or two instances have noticed a minute piece of membrane, with a ragged edge, hanging from the rim of a hydrotheca. The hydrocaulus is very characteristic, the distal part being often twice the size of the basal portion.

Sertularella tricuspidata, Hincks. Plate xii., figs. 26, 27.

There are specimens of a *Sertularella*, collected at four or five different localities, which I at first thought to be a new species, and closely allied to *S. tricuspidata*, but upon examining them more closely, I find them to be robust forms of the above-named species.

The gonangia are very abundant, and are borne in rows on the upper side of the branches.

Hab. Semidi Islands, Alaska; 15 to 25 fathoms, gravel, June 10th; gonangia abundant. Popoff Straits, Shumagin Islands. Unalashka; beach. Port Etches, Alaska; 12 to 18 fathoms, clayey mud. Yukon Harbor, Big Koniushi, Shumagin Islands; 6 to 20 fathoms, gravel, July 7th. Kyska Harbor; 10 fathoms, rocky, July 15th. Iliuliuk, Unalashka; 13 fathoms, stony.

There is one specimen which is much more delicate than any of the others, but differs in no essential characters. The gonangia are not present.

Hab. Semidi Islands, Alaska; 15 to 25 fathoms, gravel, June 10th.

Sertularella rugosa, Gray. Plate xiii., fig. 31.

This species, which has only been found upon the New England coast at low water, is represented on the shores of Alaska by a stout form, which was found in from six to twenty fathoms. Although the gonangia are not present, the trophosomes are so characteristic that I do not hesitate to refer them to this species.

Height of the largest shoot 30 mm.

Hab. Iliuliuk, Unalashka; on kelp, Oct. 23, 1871. Yukon Harbor, Big Koniushi, Shumagin Islands; 6 to 20 fathoms, sand and rocks, July 17th. St. Paul Island (Pribiloff group); 9 fathoms, sand, on kelp ground. Cape Etolin, Nunivak Island; 8 fathoms, stony.

Sertularella polyzonias, Gray. Plate xiii., figs. 34, 35.

A number of very fine specimens of this widely distributed species are in the Alaskan collection. They vary but very slightly from the New England specimens, the hydrothecæ and gonangia

being on the average a trifle stouter, and the whole colony has a more luxuriant growth.

The gonangia are very abundant, and are borne on the sides of the stems, midway between two hydrothecæ. Our specimens are all from two localities.

Height of largest specimen 70 mm.

Port Etches, Alaska; 12 to 18 fathoms, clayey mud. Five miles southwest of the West Cape of Nunivak Id.; 30 fathoms, sand.

Sertularella robusta, sp. nov. Plate xiii., figs. 32, 33.

Trophosome. Hydrocaulus simple, erect, stout, flexuous, four or five annulations at the base, divided by transverse joints into internodes of variable length, sparingly and regularly branched; branches erect, varying greatly in length, those near the base of the hydrocaulus being longest, and like the upper and shorter ones extending to the distal end of the stem, flexuous, constricted at the base, the larger ones bearing a few branchlets. Hydrothecæ very large, operculated, deeply immersed in the stem, only enough of the distal end to include the teeth being free, curving slightly outward, the inner angle of the base somewhat produced downwards toward the centre of the stem, the rim armed with four stout teeth; operculum consists of four segments.

Gonosome. Gonangia axillary, very large, sessile, ovate, marked with about eight very prominent transverse bands; orifice terminal at the extremity of a short tube, with an entire rim.

Hab. Yukon Harbor, Big Koniushi, Shumagin Islands; 6 to 20 fathoms, sand and rocks, July 7th.

This is one of the stoutest forms of all the numerous *Sertularidæ* from the Alaskan coast; and the large size and conspicuous position of the gonangia contribute to make it the most imposing of all the known members of the family. It has a very rigid, angulated habit, more like some of the stouter species of *Sertularia*, e. g., *S. abietina*, than the graceful curved mode of growth usually found in *Sertularella*. The shape and arrangement of the hydrothecæ is also similar to that usually found in the genus *Sertularia*, and the deep immersion of the hydrothecæ in the stem remind one of the forms belonging to the genus *Thuiaria*.

The stem, branches, and branchlets are all of about the same width, 1 mm. Height of largest colony 50 mm. Length of gonangia 5 mm., width 2 mm.

It is quite interesting to note that while this species is undoubtedly a good *Sertularella*, as is indicated by the form and structure of the gonangia and the operculated hydrothecæ, it also possesses some of the characteristics of the genera *Sertularia* and *Thuiaria*, thus still more closely connecting these different members of the family *Sertulariidæ*.

Sertularella pinnata, sp. nov. Plate xii., figs. 28, 29.

Trophosome. Hydrocaulus simple, erect, straight, much and pinnately branched, divided by transverse joints into short internodes, each of which bears a single branch; shoots occurring in dense clusters; each shoot widest in the middle and tapering more rapidly towards the base than to the distal extremity; branches short, sub-erect, not all in the same plane, inclining towards each other on the upper side of the stem, divided into short internodes, but little subdivided, occasionally a long branch occurs near the base, which is similar to the main stem in all respects. Hydrothecæ short, tubular, wide-mouthed, rim ornamented with three large teeth, two of which are usually on the outer side, not all in the same plane, but inclining towards each other, so that in a general view they appear to be arranged uniserially; hydrothecæ on the pinnæ arranged alternately, one to each internode and on the main stem one in each axil. Gonangia ovate, sessile, axillary. marked with about eight very strong transverse ridges, which, in most of the specimens, have an irregular, wavy outline, orifice terminal, central, discoidal; borne in two rows, in the axils, on the basal half of the stems.

Height of finest specimens 35 mm.

Hab. Unalashka; beach, low water, after gale, September; growing in dense tufts on sea-weeds, gonangia abundant. Coal Harbor, Shumagin Islands; low water, attached to fuci and sponges, gonangia abundant. Lituya Bay; 9 fathoms, sandy mud; gonangia present. Lituya Bay; 112 fathoms.

This is a very distinct form, well characterized by the pinnate arrangement of the branches, the arrangement of the hydrothecæ, and by the structure and arrangement of the gonangia.

Thuiaria cylindrica, sp. nov. Plate xvi., fig. 57.

Trophosome. Hydrocaulus erect, simple, stout, gradually tapering from the distal end to the base, divided by oblique joints into internodes of very variable length, three or four annulations at

the base, regularly branched; branches cylindrical or polygonal, arranged alternately, bearing from one to three branchlets near the base which are of equal size and nearly equal length with the branches, or unbranched; constricted at the base; occasionally a large branch occurs which resembles the main stem in every particular. Hydrothecæ tubular, entirely immersed, tapering at the distal end, curved slightly outwards, aperture oval, those upon the stem are arranged in two opposite rows on the same sides with the branches, three between each two branches; those upon the branches and branchlets are in regular rows of from four to six in number. *Gonosome.* Gonangia unknown.

Height of largest specimen 130 mm.

Hab. Port Möller, Aliaska Peninsula; 5 to 17 fathoms, sand, August. Hagmeister Island, Bering Sea; beach. Chirikoff Island; beach. Chiachi Islands; 8 to 15 fathoms, gravel.

There is considerable variation in the mode of growth of this species. The largest specimen has a straight stem with short pinnate branches, not over half an inch (13 mm.) long, and bearing but few very short branchlets. Another specimen has a twisted stem, giving a very graceful, spiral form to the colony; and four or five of the specimens in which the branches bear long spreading branchlets have a stout plumose form as if the branches orignated from all sides of the stem.

Thuiaria robusta, sp. nov. Plate xv., figs. 53, 54, 55.

Trophosome. Hydrocaulus simple, erect, slender at the base, gradually increasing in size to the distal end, divided by transverse joints into internodes of uniform size, a few annulations at the base, regularly branched; branches short, spreading, curving outwards and downwards, springing from all sides of the stem, one to each internode, bearing four or five branchlets, internodes of unequal size; branchlets few, short and diverging at a wide angle. Hydrothecæ vary greatly in form, those upon the branchlets and extremities of the branches curve quite strongly outwards, may be immersed up to the aperture in the stem, or the distal third may be free, aperture large, bi-labiate, with the broad side towards the stem; those upon the median portions of the branches are long, completely immersed, aperture smaller and not as distinctly bi-labiate as those upon the branchlets; those upon the proximal portion of the branches are shorter than the others, much smaller, aperture large, slightly bi-labiate with a singular

process of the perisarc in the shape of a two-pointed pyramid at the base of each hydrotheca; all the hydrothecæ upon the branches and branchlets are arranged sub-alternately; those upon the main stem are similar to those of the proximal portions of the branches, usually two to each internode which are placed about opposite to each other, occasionally a third one occurs in the axil of the branch. The perisarc is unusually thick, and especially so in the basal third of the hydrocaulus where the diameter of the cavity of the cœnosarc is not more than a third of that of the stem.

Gonosome. Gonangia largest at distal end tapering to the base, sessile, about twice the length of the hydrothecæ, not including the horns, armed with two stout, cylindrical, truncate horns placed on opposite sides of the aperture near the distal end, aperture terminal, discoidal.

Hab. Sea Horse Islands, Arctic Ocean; 23 fathoms, mud and gravel. Hagmeister Island, Bering Sea; beach. Cape Prince of Wales, Arctic Ocean; mud. Bering Sea, 12 miles east of King's Island; 17 fathoms, mud.

Thuiaria plumosa, sp. nov. Plate xvi., fig. 62.

Trophosome. Hydrocaulus simple, erect, very slender at the base, increasing in size to the distal end, somewhat twisted, jointed transversely, internodes of the proximal portion of very unequal length, some being three times the length of others, those of the upper portion are quite uniform, regularly branched; branches short, arranged alternately, one to each internode, but owing to the twist in the stem take on a spiral form, the uppermost erect, lying close to the stem, the lower ones curve outwards, attached to the stem by a very prominent process, bearing a few branchlets, regularly jointed; branchlets do not extend beyond the ends of the branches, and lie close to the latter. Hydrothecæ largest at the base, tapering slightly outwards, entirely immersed, aperture towards the stem, the outer side produced, rim ornamented with two large teeth placed on the outer side, two tooth-like processes of the perisarc also occur in the base of each hydrotheca, arranged subalternately upon the branches and branchlets; upon the stem there are three to each internode, two placed opposite to each other, and one in the axil of the branch. *Gonosome.* Gonangia sessile, very long and narrow, tapering gradually to the base, ornamented with two short

horns placed on opposite sides of the orifice near the distal end, orifice terminal large; borne in single rows on the upper side of the branches and branchlets.

Height of largest specimen, 40 mm.

Hab. Bering Sea, 5 miles southwest of the west cape of Nunivak Island; 30 fathoms, sand. Icy Cape, Arctic Ocean; 15 fathoms, sand.

In general appearance this species cannot be distinguished from *Sertularia thuiarioides*, and even in some of the details of structure they bear a very close resemblance to each other; the best distinguishing characteristic in the trophosomes is the form of the aperture in the hydrothecæ, and in the gonosome the size and relative proportions of the gonangia. The twist in the stem and the erect position of the branches give to this species a very graceful mode of growth, which bears a striking resemblance to a feather.

Thuiaria turgida, sp. nov. Plate xvi., figs. 58 to 61.

Trophosome. Hydrocaulus simple, erect, stout, straight or slightly flexuous, of nearly uniform size throughout, joints oblique, internodes short, of equal size, annulated at the base, the lower portion without branches, the upper or distal part regularly branched; branches broad, short, arranged alternately, one to each internode, constricted at the base, attached to quite a prominent process from the stem, with one annulation, divided by transverse joints into internodes of variable length, sparingly branched; branchlets diverging from the branches at a wide angle, usually curving towards each other. Hydrothecæ large, tubular, deeply immersed in the stem, curving slightly outwards, aperture large, rim entire, arranged oppositely on the branches and branchlets; on the upper portion of the stem there are three to each internode, a pair opposite to each other, and one odd one in the axil of the branch; on the lower part of the stem there are two to each internode. *Gonosome.* Gonangia large, swollen, sessile, with three to five stout, longitudinal ridges, orifice terminal, small, discoidal; arranged in two closely set rows on the upper portion of the main stem.

Height of largest specimen, 140 mm.

Hab. Port Etches; 5 to 8 fathoms, gravel and stones, May 30. Popoff Straits, Shumagin Islands; near edge of reef in 6 fathoms, July. Semidi Islands; 15 to 28 fathoms, gravel, June 10. Coal

Harbor, Shumagin Islands; beach. Eider village, Unalashka; 25 to 30 fathoms, sandy mud, June 4. Hagmeister Island, beach. Unalashka; 6 fathoms, Nov. 11. Kyska Harbor, Aleutian Islands. Lituya Bay; 9 fathoms, sandy mud. Akutan Pass, near Unalashka. St. Paul Island (Pribiloff group); 9 fathoms, in kelp, July 24. Middleton Island; 12 fathoms, gravel, June 2.

This species is one of the most abundant in the collection. It is a showy form, and has quite a stout appearance, owing to the width of the branches and stem throughout, and the large gonothecæ forming a double, close-set row along the distal third of the stem add not a little to its showiness.

Thuiaria gigantea, sp. nov. Plate xvi., figs. 63, 64.

Trophosome. Hydrocaulus simple, erect, rooted by a creeping stolon, stout, straight, divided by transverse joints into internodes of variable length, much and quite regularly branched; branches suberect, short, stout, usually unjointed, seldom branched all in one plane, arranged alternately on opposite sides of the stem from within an inch of the base to the very tip, constricted at the base. Hydrothecæ large, deeply immersed, curving outwards, orifice large, somewhat elliptical, arranged subalternately upon the stems and branches. *Gonosome.* Gonangia borne in two rows on the upper sides of the branches and branchlets, usually occurring towards the distal ends of the stems, sessile, obovate, with an irregular outline, orifice terminal, large, discoidal.

Height of largest specimen, 165 mm.

Hab. St. Paul Island, Bering Sea. Hagmeister Island; beach. Akutan Pass, near Unalashka. Kyska Harbor; 10 fathoms, rocky, July 15.

The finest specimens consist of a dense cluster of about 350 shoots, averaging six inches in length, attached to a large barnacle; it is much the largest single specimen in the collection, containing just about one million individuals, exclusive of the reproductive zooids, and it can just be crowded into a two-quart jar. The conditions for the existence of life must be very favorable where such a luxuriant growth as this is obtained from a root-stock that covers only a piece of an old barnacle shell.

Macrorhynchia Dallii, sp. nov. Plate xi., figs. 18, 19, 20.

Trophosome. Hydrocaulus erect, compound, very stout, black, straight or gracefully curved at the distal end, not divided by

joints, the lower portion sometimes as much as the lower third, bearing no pinnæ, but give origin to two or three branches which often equal the main stem in size, and resemble the latter in every particular, the upper portion bears a double row of closely set pinnæ. Pinnæ arranged alternately on opposite sides of the stem and branches, gracefully curved, more or less, towards each other, giving off near their origin from one to three branches, which are exact copies of the main pinnæ, equal the latter in length, and lie so closely upon each other, that they are not noticed in a casual glance; both the pinnæ and their branches are divided by transverse joints into short internodes. Hydrothecæ arranged uniserially upon the pinnæ and their branches, one to each internode, narrowest at the base, rim entire and slightly flaring. Nematophores simple, very large, the distal portion free, semicylindrical, very broad, one on either side and at the upper edge of the hydrothecæ, facing inwards, one just below each hydrotheca, and on the main pinnæ, sometimes two, one directly below the other, there are also two or three near the base of the gonangia irregularly arranged.

Gonosome. Gonangia very large, quite regularly cylindrical, tapering at the base, sessile, mouth discoidal and the full size of the gonangia, rim entire; scattered over the pinnæ and their branches.

Height of finest specimen 225 mm. Width of largest hydrocaulus at base 5 mm. Length of largest gonangium 4 mm.

Hab. Unalashka; beach. Akutan Pass, near Unalashka; beach.

This is one of the largest, stoutest, and by far the showiest and most elegant species in the collection, and I take pleasure in naming it after Mr. Dall, through whose untiring labor and skilful care this fine collection has been made, and kept in a good state of preservation.

In the mode of growth and external characters this species has all the appearances of a true *Aglaophenia*, and the large cylindrical gonangia partially hidden by the dark-colored pinnæ are readily mistaken for corbutæ.

ATHECATA.

Tubularia borealis, sp. nov.

Trophosome. Hydrocaulus simple, erect, slightly annulated or twisted at the base, largest at the distal end and tapering gradually to the base, smooth, not forming a collar-like expansion below

the hydranth, light straw-color. Hydranths large, drooping; proximal tentacles thirty to thirty-two in number, arranged in a single verticil; when expanded forming a circle with a diameter of twenty to twenty-four mm.; distal tentacles fifty to sixty, arranged in a double row so closely as to form a single verticil. *Gonosome.* Gonophores oviform with four crest-shaped, laterally compressed, tentaculiform processes, arranged in pendant racemes of six to nine in number, which, when mature, are twice the length of the hydranth, and bear from thirty to seventy sporosacs each. No radiating canals are discernible in these alcoholic specimens, yet they may exist.

Length of stem 60 mm.

Hab. Hagmeister Island; beach, low-water.

In general appearance this species bears quite a close resemblance to *Tubularia indivisa;* the light-yellow, stout stems, and the large heads of both would hardly fail to mislead one at a casual glance. If there really are no gastrovascular canals in the sporosacs this form belongs in the sub-genus *Parypha* of Agassiz, but if the canals are present it makes it a still more interesting form, it then being intermediate between the sub-genera *Tubularia* proper of Agassiz, and *Parypha* of Agassiz.

Tubularia indivisa, Linne.

A number of very characteristic specimens of this widely-distributed species have been received from Alaska. The stems are very much interlaced, and many younger ones have attached themselves to older stems, thereby producing a branched appearance. Where the young stems have become closely twined about the older ones, it gives to the latter an appearance like that of the large confluent stem of *Halecium muricatum.*

Hab. St. Michael's, Norton Sound; collected by Mr. L. M. Turner, who describes them as very abundant in small pools left by extreme low tides.

Eudendrium pygmæum, sp. nov.

Trophosome. Hydrocaulus simple, erect, stout, rooted by a creeping stolon, annulated throughout, irregularly branched; branches erect, and bearing but few branchlets. Hydranths large, the stout tentacles, which vary in number from sixteen to twenty, are arranged in a single verticil. *Gonosome.* Sporosacs arranged in crowded rows beneath the tentacles, nearly spherical or pointed

at the distal end, and from thirty to forty-five or even fifty in a cluster.

Height of specimen 20 mm.

Hab. Akutan Pass, near Unalashka.

This is a short, stout form, of a blackish-brown color at the base, becoming lighter towards the distal ends of the branches. It resembles the dried stems of a Eudendrium that occurs at Santa Cruz, California, in being annulated throughout, and may prove to be identical.

Nov. Fam. (?) RHIZONEMIDÆ, S. F. Clark.

Polypites attached by numerous thread-like fibres. Tentaculæ apparently of two kinds; the inner verticil of aboral tentacles branched.

Nov. Genus RHIZONEMA, Clark.

Polypes solitary, unconnected. Basal portion of the polypite swollen, mammillate, with the thread-like processes for attachment developed therefrom.

Type Rhizonema carnea, sp. nov.

Stems stout, unbranched, smallest at the distal end; of a nearly uniform size for two-thirds of the distance toward the base, at which point they begin to increase in diameter rapidly to twice the diameter of the distal end, then taper rapidly to quite a sharp point like an acorn. The processes for attachment are developed in large numbers (hundreds) from the basal surface of the enlarged portion of the stem. They are of a light-brown color, and form a matted mass which extends beyond the sharp-pointed base. The polype is large and turgid; its length much greater than its width. The aboral tentacles are about forty in number, very slender and delicate, reaching a trifle beyond the end of the proboscis. Just within these tentacles is situated another circle of processes, the exact nature of which can be determined only from fresh specimens.

The proboscis is very large and swollen, and bears around its distal end the proboscidial tentacles, which are as delicate as the finest thread, very numerous, and so matted together in the specimen before me that it is impossible to form any correct estimate of their number. The mouth, situated at the extremity of the

proboscis, is very large. Length of head, 13 mm. Length of swollen basal portion, 21 mm. Total length of perfect specimen, 68 mm.

The specimens from which the above description was written were collected at St. Michael's, Norton Sound, Alaska, Oct. 17, 1875, by Mr. Lucien M. Turner, U. S. Signal Service, who appends the following note: "These specimens were of a deep coral red when found. They are not common. From the sea."

They are two in number, one of which is perfect—the other is without a head, but bears at the distal end a thin chitinous membrane surrounding the stem; its edges recurved and marked with a few faint radiating lines.

From the appearance of the individual, I am of the opinion that the head had been thrown off, and that another was about to be developed.

The matted masses of delicate fibres about the basal portion present a very peculiar appearance.

When cleared away so as to expose the pointed basal end of the stem, that part has a close resemblance in miniature to a beet-root with an unusual number of fibrous rootlets.

Under the microscope, each fibrous process appears to be developed from a small rounded papilla; some papillæ which bore no fibres exhibited an opaque milk-white nucleus. The nature and development of these processes is a matter of considerable interest, but I think that little could be done even with a large supply of only alcoholic specimens. The nature of the inner verticil of aboral tentacles (?) is also a very interesting question. From their position, and from their compound appearance, they would naturally appear to be clusters of reproductive bodies. On the other hand, the alcoholic specimens under the microscope do not show the structure characteristic of such bodies. They appear to be thin, flattened, branched tentacles, and have no swelled or thickened portions such as would indicate anything like reproductive organs. It is, of course, impossible to determine their nature positively without further material.

This is certainly a very peculiar and very interesting form, on account of its peculiarly shaped base, its apparently compound tentaculæ, and the thread-like processes for attachment, which seem, on account of the pointed base, to be necessary for its secure anchorage.

ORDER LUCERNARIÆ.

Family ELEUTHEROCARPIDÆ, H. J. Clark.

Haliclystus auricula, H. J. Clark.

Twenty or thirty good specimens of this interesting form have been collected at St. Michael's. They are in good preservation, and represent various stages of development. In some of the larger specimens the ovaries are very far advanced, much enlarged, nearly filling the entire cavity, and greatly distending the body walls. In others the ovaries show no enlargement, and between these two conditions all intermediate stages are represented.

The color is light brown, with a bluish tinge, which becomes darker with the development of the ovaries. Three of the specimens have ten arms and three have twelve, showing a marked tendency to variation in this respect.

Geographical distribution: St. Michael's, Norton Sound, Alaska; Mr. L. M. Turner, Oct. 17, 1875. Vardöe Islands, Norway; Rathke. Faröe Islands; Steenstrup. English coast; Montague, Fleming, Johnston, and others. South coast of Greenland; Steenstrup. Anticosti; Hyatt, Verrill, and Shaler. Massachusetts Bay; H. J. Clark.

EXPLANATION OF PLATES.

The figures on plates vii. to xi., inclusive, are enlarged 30 diameters, with the exception of Nos. 16, 19*e* and 19*g*; the extent to which the latter are magnified is indicated on the plates.

The figures on plates xii. to xvi., inclusive, are magnified 20 diameters, with the exception of No. 33, which is enlarged 7 diameters.

PLATE VII.

Fig. 1. *Gonothyrea hyalina; a*, hydrothecæ; *b*, gonangium; *c*, extra-capsular medusoids with tentacles; *d*, cœnosarc, or fleshy axis.

Fig. 2. The same; portion of a branch, showing the arrangement of the hydrothecæ.

Fig. 3. *Campanularia circula;* showing, *a*, hydrotheca; *b*, main stem, and the verticillate arrangement of the pedicels around the stem.

Fig. 4. *Campanularia denticulata;* the hydrothecæ, showing the variation in shape and size. Specimen from Port Etches; creeping on Lafoëa.

Plate VIII.

Fig. 5. *Campanularia compressa;* *a*, gonangium; *r*, rootstock or creeping stem.

Fig. 6. The same; showing the variation in size and form of the hydrothecæ.

Fig. 7. *Campanularia urceolata;* *a*, hydrothecæ; *b*, gonangium.

Fig. 8. *Campanularia turgida;* *a*, hydrotheca; *b*, gonangium; *r*, rootstock.

Plate IX.

Fig. 9. *Campanularia integra;* showing the variation in the hydrothecæ.

Fig. 10. The same; *b*, gonangium; *r*, rootstock.

Fig. 11. *Campanularia speciosa;* *a*, hydrothecæ; *r*, rootstock, or creeping stem.

Fig. 12. *Clytia Johnstoni;* showing the variations in the stems and hydrothecæ.

Plate X.

Fig. 13. *Halecium scutum;* *a*, hydrothecæ; *b*, gonangia; *c*, ova; *d*, aperture of gonangia.

Fig. 14. The same; *a*, portion of a branch; *b*, portion of main stem.

Fig. 15. *Halecium muricatum;* gonangium.

Fig. 16. *Halecium plumularioides;* *a*, portion of a branch; *b*, portion of main stem; *c*, hydrothecæ.

Fig. 17. The same; *a*, branch; *b*, main stem; *r*, rootstock.

Plate XI.

Fig. 18. *Macrorhynchia Dallii;* *b*, main stem; *a*, pinnæ; *c*, hydrothecæ; *d*, nematophores.

Fig. 19. The same; *e*, a cross section of main stem near the base; *g*, gonangium; the other letters as in fig. 18.

Fig. 20. The same; the letters as before.

Fig. 21. *Lafoëa pocillum ?; a*, hydrothecæ; *r*, rootstock.

Plate XII.

Fig. 22. *Lafoëa fruticosa;* a branch with hydrothecæ. Shumagin Islands, 6 to 20 fathoms.

Fig. 23. *Lafoëa dumosa; a*, main stem; *b*, hydrothecæ.

Fig. 24. *Lafoëa gracillima; a*, main stem; *b*, hydrothecæ.

Fig. 25. *Calycella syringa; a*, hydrothecæ; *b*, opercula; *r*, rootstock.

Fig. 26. *Sertularella tricuspidata;* slender variety, from the Semidi Islands.

Fig. 27. The same; stout variety, also from the Semidi Islands.

Fig. 28. *Sertularella pinnata;* portion of a branch.

Fig. 29. The same; *a*, portion of a branch; *b*, gonangium; *c*, internal chamber.

Fig. 30. *Sertularia filicula; a*, main stem; *b*, branches.

Plate XIII.

Fig. 31. *Sertularella rugosa;* portion of a branch with hydrothecæ, from the Shumagin Islands.

Fig. 32. *Sertularella robusta;* portion of a branch; *a*, hydrothecæ; *b*, opercula.

Fig. 33. The same; gonangium.

Fig. 34. *Sertularella polyzonias; a*, hydrothecæ.

Fig. 35. The same; gonangium; *r*, rootstock.

Fig. 36. *Diphasia mirabilis;* portion of a branch.

Fig. 37. *Sertularia cupressoides; a*, portion of a branch; *b*, portion of main stem.

Fig. 38. *Sertularia thuiarioides; a*, gonangia; *b*, portions of branches.

Fig. 39. The same; *a*, portion of a branch; *b*, gonangium.

Plate XIV.

Fig. 40. *Sertularia variabilis;* portion of a branch.

Fig. 41. The same; a stouter form.

Fig. 42. The same; a form in which the hydrothecæ are more elongated.

Fig. 43. The same; a slender form in which the hydrothecæ are arranged more in pairs; *a*, the apertures where the gonangia were attached.

Fig. 44. The same; *a*, portion of a branch; *g*, gonangia from same colony.

Fig. 45. The same; a stouter form, in which the hydrothecæ are quite divergent.

Fig. 46. The same; the stoutest of the many varieties; the three pairs of hydrothecæ are all from the same branch.

Fig. 47. The same; gonangia.

Fig. 48. The same; still another form, the divergent characters of which are not constant; not even in different portions of the same colony.

Plate XV.

Fig. 49. *Sertularia variabilis;* the three pairs of hydrothecæ are all from the same stem.

Fig. 50. The same; the most extreme of the many forms.

Fig. 51. *Sertularia inconstans;* three gonangia which grew next to each other, showing how variable they are.

Fig. 52. The same; portion of a branch.

Fig. 53. *Thuiaria robusta; a*, portion of main stem, showing the thickness of the perisarc or chitinous walls; *b*, side view of basal portion of a branch; *c*, side view of portion of stem.

Fig. 54. The same; *d* and *e*, portions of branches.

Fig. 55. The same; gonangia.

Fig. 56. *Sertularia similis;* portion of a branch.

Plate XVI.

Fig. 57. *Thuiaria cylindrica;* showing the unusual arrangement of the hydrothecæ and the mode of branching.

Fig. 58. *Thuiaria turgida;* gonangium.

Fig. 59. The same; portion of a branch and branchlet.

Fig. 60. The same; portion of main stem.

Fig. 61. The same; portion of a branch.

Fig. 62. *Thuiaria plumosa; b*, portion of a branch; *g*, gonangia.

Fig. 63. *Thuiaria gigantea;* a side view of main stem; *b*, gonangia; *c*, hydrothecæ.

Fig. 64. The same; portion of a branch.

ON THE EXTRUSION OF THE SEMINAL PRODUCTS IN LIMPETS, WITH SOME REMARKS ON THE PHYLLOGENY OF THE DOCOGLOSSA.

BY W. H. DALL, SMITHSONIAN INSTITUTION.

In a paper published in the American Journal of Conchology, Part III., 1871, I brought together a summary of the various details published from time to time by various naturalists, upon the anatomy and physiology of this group. In that paper it was shown that the manner in which the seminal products were freed from the ovary and testis, and the passage by which they reached the exterior, was unknown, and from the investigations of Lankester and myself, that the existence of the oviduct figured by Cuvier (Mém. sur les Moll., 15, 1817), if not actually disproved, was at least a matter of grave doubt, and had not been confirmed by any subsequent examination. Lankester (Ann. Mag., N. H., xx. p. 334, 1867) had suggested that the passage of the ova to the exterior was made through two orifices first described by him and termed "capitopedal orifices." These were said to open, "one on each side of the head in the angle formed by its junction with the muscular foot, and (internally) opening into the blood sinus surrounding the pharyngeal viscera." He also described an opening communicating between the "pericardium and the supra-anal articulated sac," or accessory renal organ. The latter I have never been able to demonstrate to my own satisfaction, but I do not assume to dispute its possible existence. In the brief notice of his work published by Mr. Lankester, which has not been followed by any more detailed communication, the terms used were somewhat misleading, or at least not clear. Instead of opening externally in the angle formed by the head and the foot, the "capitopedal orifices," if I have correctly identified them, are situated on the back of the neck, so to speak, or more properly on the transverse portion of the integument above the head and in front of the main pericardial chamber in the angle formed by the neck and the inferior surface of the mantle over the head. Mr. Lankester found them in *Patella vulgata*, but I have never been able to detect them in the few alcoholic specimens of that species which I have been able to examine. In fresh specimens of *Acmæa patina* and *testudinalis*, I have generally been able to

find them, and in the living animal they are of an orange color. In *Ancistromesus mexicanus*, they are quite prominent in some cases and almost imperceptible in others. They also differ in character. In *Ancistromesus* (one of the *Patellidæ*), they appear as true orifices, in the acmæas they present the appearance of an elongate, narrow, glandular mass, from which, internally, a duct is not always traceable. In some individuals they appear entirely absent or abortive. My own opinion of their function is, that they are aquiferous pores, such as are common to many mollusks, through which water passes into the circulation directly in the *Patellidæ* and by a process of straining through the glandular mass in the *Acmæidæ*. Whatever their office, it can hardly be of fundamental importance, or they would not be so frequently found in an abortive condition. Whether in some cases they may be indirectly in communication with the renal sac is of little consequence, as, in the paper alluded to, I have shown that in some genera the pericardium is so situated that there can hardly be any such communication, and in so homogeneous a group as the limpets it is unlikely that such an anatomical character, if important, should be inconstant.

Moreover, through the intricate channels alluded to, the ova which are of considerable size could hardly be propelled without some special muscular arrangement which does not seem to be present in any case examined. Anxious to set at rest a question of so much interest, and which for so many years had puzzled anatomists, I have lost no opportunity of dissecting animals of this group, especially the large species in which the characters might be supposed to be more evident. The opacity of the shell and the impossibility of getting at even the external orifices of the viscera without destroying the life of the individual, proved effectual obstacles to the study of these functions in the living animal. While in the field, from 1871 to 1874 inclusive, I made dissections of many hundreds of acmæas with no definite result, except that of finding that the sexual products appeared ripe in only a small portion of the ovary at any one time, and in the acmæas the portion most usually in that condition was the extreme right hand part of the anterior end, immediately below the floor of the larger renal sac. No oviduct or opening was in any case demonstrated.

Somewhat discouraged by repeated failure, on leaving the field-

work in which I had been engaged, the matter was deferred until a better opportunity should arise. Some time since, a large number of specimens of the giant limpet of Central America, *Ancistromesus mexicanus*, were obtained by the Museum of Comparative Zoology from the naturalists of the Hassler Expedition. By the courtesy of Prof. Alex. Agassiz a number of these were turned over to me for dissection.

In this species the right supra-renal sac is quite large, covering the entire superior surface of the animal between the muscular attachments. The viscera are coiled below it in the usual manner, except that in ripe individuals the upper outer edge of the ovary or testis extends rather more beyond the peripheral coil of the intestine than in most species. A section then discloses the membranes in the following order from above.

First, the external delicate layer of the mantle covering everything else, and very intimately bound together by tough connective tissue with,

Second, the superior wall of the right hand (and only fully developed) renal sac. By means of delicate, but tough columnar walls of tissue, forming connected cellular cavities, overlaid with semi-glanduiar tissue for the elimination of the renal secretions, the upper wall of this sac is connected with,

Third, the floor of the sac, of similar constitution and toughness. The two are readily separated owing to the greater delicacy of the connecting tissues, but the upper wall and the mantle, and the lower wall and the tissues below it, are very intimately connected by membranous fibres of such toughness as to render their separation without injury very difficult.

A muscular band or mesentery of considerable strength, having, in the specimens of *Ancistromesus* examined, a width equal to nearly one-twenty-fifth of its length; extends completely around the internal viscera which are compactly bound together by similar tissue.

From the floor of the renal sac similar but short mesenteric bands extend downward to the peripheral band, radiating from the apex of the shell, and having, when in their natural position, a somewhat triangular form; the short sides of the triangles corresponding to the distal ends of the radii, and their plane surfaces being nearly vertical to the horizontal plane of the visceral mass. In the specimen under consideration there were one posterior and

ten lateral bands of this nature, five on each side. In details of form and dimensions these vary in different individuals. They widen at their junction with the tissues above and below, and send off numerous fibres in all directions, and especially to the peripheral band. We thus have as it were the entire visceral mass suspended in the perivisceral cavity, free of the floor and sides of the latter (except a delicate anchoring membrane, lying vertically in the median line and connecting the median line of the visceral mass with that of the muscles of the foot), but in contact or close connection with its roof which is composed of the floor of the larger renal sac. This sac opens externally by a prominent papilla to the right of the anal papilla, while the smaller (and usually almost abortive) left renal sac, opens by a proportionally smaller papilla to the left of the anal.

The specimens were examined by cutting away the solid muscular foot, and thus exposing the perivisceral cavity without in any way lacerating its contents, sides, or upper surface. A number of individuals were dissected without coming any nearer to the object in view. At last, however, a specimen was taken up which appeared to solve the difficulties and afford the long sought for explanation. It was a male. The surface of the viscera with one exception was perfectly normal. On the right-hand posterior portion of the periphery of the testis, covered with its usual delicate investing membrane, for the space of an inch from the posterior end of the median line, forward, the ducts were swollen and enlarged. They projected in a marked manner from the smooth and evenly rounded normal surface, like "varicose veins," except that the ducts are nearly parallel. In the ripest portions the delicate investing membrane of the testis had become ruptured or perforated, and the seminal matter exuding from these punctures had been solidified by the alcohol in little rounded grains or particles, which had not been disturbed by the careful manipulation of dissection.

At those points where the congested or enlarged ducts were in mechanical contact with the roof of the perivisceral cavity, that is to say, the floor of the renal sac, numerous minute, but plainly visible, oval perforations appeared. These were oblique to the general plane of the membrane, the opening on the side adjacent to the testis being usually directed somewhat backward instead of vertically downward. They had also something of a funnel shape, being larger on the side toward the testis, and some of them

were twice as large as others. The largest had a diameter of .015 in., and would admit the passage of a fine bristle into the renal sac. On applying slight pressure from above, the fluids contained in the renal sac passed through in a minute jet. They were irregularly distributed, corresponding in locality to the ripeness of the ducts of the testis. Except where the testis in its ripe condition was in immediate proximity or actual contact with the membranes of the renal sac, *no such orifices or pores were to be found.* In the other specimens in which the testis or ovary showed none of these signs of maturity, no such orifices could be detected. The membranes in such cases presented a smooth and practically impervious surface in every part.

It would seem as if these facts gave a final solution to the difficulty as follows:—

When the ovary or testis is ready to discharge its products, that portion of it which is ripe evinces its condition by an enlargement of the ducts, continuing until dehiscence takes place. Coincidently, the superincumbent membranes of the renal sac (whether by sympathy with the congestion of the seminal organ or otherwise) become lax and perforations make their appearance immediately adjacent to the dehiscent ducts. Through these orifices the seminal products make their way. A contraction of the pedal muscles would be sufficient to cause the ejection. After reaching the renal sac, the question of the extrusion of the ova or semen presents no difficulties. The same agency which empties the sac of its secretions through the renal papilla would suffice to eject the seminal products, which floating in the water would cause the fertilization of the ova as in the case of *Chiton.*

The rarity of individuals in a ripe condition in collections may be due to their repairing below tide marks at such times, and hence avoiding the collector.

The method above suggested is paralleled in numerous other invertebrates, and even some fishes, with non-essential differences of detail. The specimen referred to has been submitted to several naturalists who agree as to the facts.

While additional evidence is desirable in corroboration, I feel tolerably confident of the correctness of the inferences drawn from the above facts, which furnish an explanation at once simple and in accordance with experience in other cases, of a very puzzling question.

I may add, that the localized turgidity or swelling of the ripe seminal ducts had been previously observed by me on other occasions among specimens of *Acmæa patina;* but having dissected them in most cases from above, removing the membranes not connected by tissue with the ovary, and looking more particularly for a permanent duct or passage, the perforations of the renal membranes were likely to, and did, entirely escape my notice.

Additional notes on the genera of Limpets.—In the paper before referred to, I was unable, for want of material, to obtain data in relation to the dentition of the typical species of *Helcion* and *Scurria.* The former I have lately obtained from a dry specimen kindly communicated by Dr. Carpenter, and Mr. S. A. L. Brannan, of San Francisco presented me with an alcoholic specimen of *Scurria scurra* obtained by him at Valparaiso.

The result of an examination of the two forms shows that *Helcion* has the dentition of the typical *Patellæ* such as *P. vulgata*, except that the third or outer cusp of the third lateral tooth is obsolete. The gills are interrupted over the head as in *Helcioniscus*, from which it is sufficiently distinguished by the dentition.

Scurria scurra agrees in all essentials of branchiæ and dentition with *Scurria mexoleuca* described by me as above, so that no change of the arrangement I then adopted is necessary. A careful examination of the soft parts and dentition of some of the typical scutellinas is still a desideratum.

Having now nearly complete data in regard to the principal groups of the *Docoglossa*, a few observations may be permitted on the relations of the different subordinate groups. I will premise, that, for reasons which I hope in a short period to publish *in extenso*, I have come to the conclusion that the northwest coast of America has been a great centre of distribution for molluscan species; or of forms which, as they migrated south or east from their original habitat, changed or added to their original characters, until at present they are termed nearly related rather than identical forms. In many cases their paths have become dry land, and the track must be followed rather by organic relations than contiguity in distribution. Were the foregoing views correct, we should look to find in this region—1st, a maximum development of the lower or parent forms of *Docoglossa;* 2d, a local abundance and radiating distribution of the next higher genera; and lastly, in the nearest region where conditions of temperature, food, and station were most favorable (and the migrating organ-

isms might be supposed to have been longer exposed to these favorable conditions than those subjected to the vicissitudes of more distant migration), we should expect to find instances where the group had reached its highest form of specialization.

This is exactly the real state of the case.

Whether we consider the dentition, the mechanism of respiration, or the development of special organs, or the total bulk of the organism, the *Abranchiata* are unquestionably the lowest forms of the order. Without eyes, branchiæ, or lateral teeth, sluggish in their motions; relying on buccal tentaculæ and the cuticular nervous system for outward impressions, and protected by the uniform conditions of their deep water station, they stand at the foot of the genealogical tree.

In the Alaskan region they are represented by two or three species, which reach a larger size than any of their congeners.

Pilidium and *Lepeta* have reached the east coast of America and the Hebrides; the latter only has penetrated to the Mediterranean if identifications of Italian naturalists are to be accepted.

The rhachidian tooth, representing the type of a radula, and disproportionately developed when compared with the uncini in this group, may by natural selection have given place to the strong subequal ranks of laterals characteristic of the *Acmæidæ*, and the buccal tentacles, rendered unnecessary by the presence of eyes, disappeared, or are only represented by the smooth frill of the muzzle of *Acmæa* drawn down to a corner, while in the remainder of the family they are totally absent.

The development of the radula, of a cervical branchia, of eyes, and of general bulk, marks the progress of the group in the *Acmæidæ*. From uselessness the uncini become abortive.

In the northwest American region, more than in all the world beside, is this group developed in species, in size, and in individuals. Strong in the possession of their new organs, they have invaded the littoral zone, and only the smaller and weaker forms tarry in deep water.

On the west they have, through favorable conditions, reached Japan, China, and south to Amboyna. On the south, their unbroken ranks stud the beaches from California to Tierra del Fuego, and thence north on the east coast of South America to Rio de Janeiro. The eastern barriers at the north are not so easily overcome, and *Acmæa testudinalis* and *virginea* have alone reached northern Europe.

In the present state of our knowledge, it is easy to trace the steps of development. Greater knowledge would doubtless increase the complications.

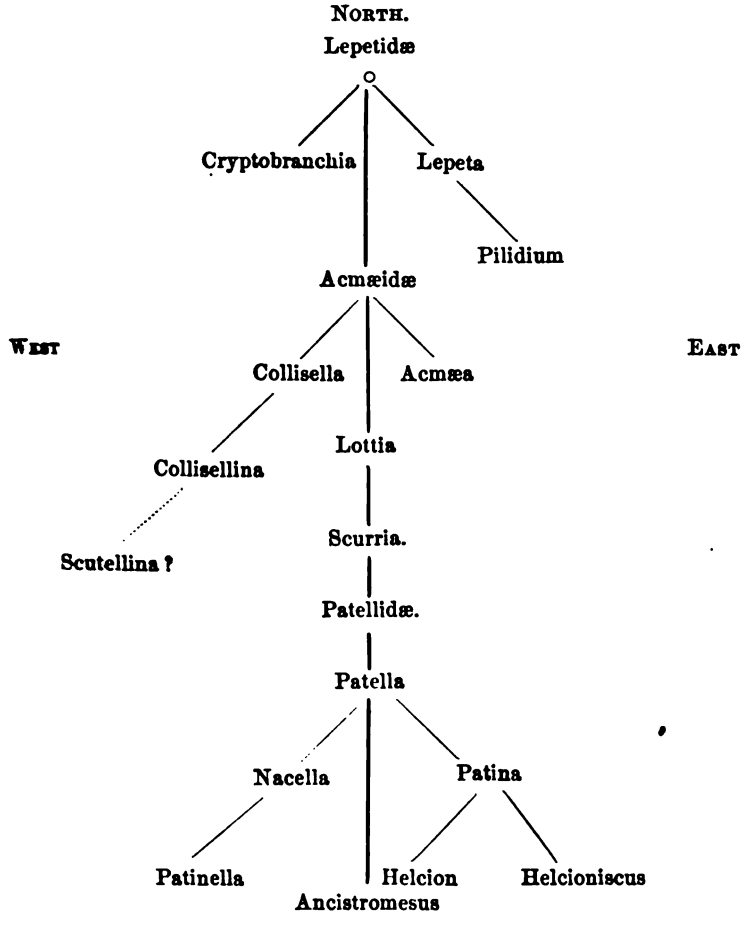
In the warm waters of California *Lottia grandis*, having reached an enormous size, is also enabled to develop an incomplete branchial cordon in addition to its cervical plume.

Further south *Scurria* completes the cordon and apparently reaches the highest stage of development short of a rejection of useless parts. This soon occurs in the disappearance of the cervical plume, whose office is abundantly filled by the development of the cordon. This brings us to the *Patellidæ*. Here the development of the radula has so far progressed that its median line, in the highest type of the family, is now supplied with a rhachidian tooth of properly proportioned size, and the abortive uncini of the *Acmæidæ* have given place to teeth which are capable of fulfilling a useful purpose. At the same time, the plain muzzle frill of *Acmæa* is replaced by a crop of arborescent tactile papillæ, and in *Ancistromesus*, the highest development of total bulk known to the order, is added to the greatest known specialization of the other characters.

This occurs on the Mexican coast in the direct line of migration from the northwest coast. So far as we yet know, the representatives of this family in more distant regions have not yet rivalled it in development. All want the median tooth; the other characters, but with much smaller bulk, are developed in *Patella vulgata* of Europe and some Indian species. *Patina* cannot complete its cordon, inhabiting the British Isles. *Nacella*, an equally distant traveller, in Patagonia, barely completes its cordon, while its associate, *Patinella*, is more successful, and both sport a frill around the foot.

Helcion and *Helcioniscus* of the African coasts, have the cordon interrupted, and the dentition is less uniform and effective than in *Ancistromesus*, which, however, they resemble in dispensing with the foot frill. In the rich Indo-Pacific region it seems probable that the higher types prevail more abundantly, and there is reason to believe that *Scutellina* is a weakly offshoot from the acmean stem.

Without verging greatly on the speculative, we may construct a genealogical tree, which cannot greatly differ from the following scheme:—


NORTH.
Lepetidæ
Cryptobranchia
Lepeta
Pilidium
Acmæidæ
WEST
EAST
Collisella
Acmæa
Collisellina
Lottia
Scutellina ?
Scurria.
Patellidæ.
Patella
Nacella
Patina
Patinella
Helcion
Helcioniscus
Ancistromesus

DESCRIPTIONS OF SOME VERTEBRATE REMAINS FROM THE FORT UNION BEDS OF MONTANA.

BY E. D. COPE.

Aublysodon lateralis, sp. nov.

Established on some teeth, one of which is of the size of those of the *A. horridus*, and which differ in some important particulars. The posterior crenate ridge is as in that species, lateral in position, separating a posterior face from the lateral at a right angle. The posterior face is separated from that of the other side by a very obtuse angle. The anterior aspect of the crown is without crenate cutting edge, but the latter is present as a border to the front, passing along the front of the side opposite to that which bears the posterior angle. It is directed laterally, and projects beyond an open groove which follows its posterior base. The base of the crown is broad elliptic in section. Enamel smooth.

A much smaller tooth was found with the preceding, and presented similar characters, excepting that the posterior face is not so strongly truncate.

Measurements.	M.
Length of crown preserved	.025
Diameter of base of crown { long	.018
Diameter of base of crown { short	.010
Width of posterior face	.006
Length of smaller crown	.011
Long diameter of base of do.	.006

The apices of both crowns are considerably worn by use. Both were found by Charles H. Sternberg of my exploring party.

Lælaps incrassatus, sp. nov.

Represented by two teeth, a larger and a smaller, which were found near each other, but not sufficiently so as to warrant the belief that they pertain to the same individual.

The characteristic feature of these teeth is, that the transverse diameter of the base of the crown exceeds its anteroposterior, a point in which it differs from all the other carnivorous dinosaurians yet known from the formation. Nevertheless, the posterior cutting edge is median, and is denticulated. The anterior cutting edge, which is also denticulated, is nearly median at the apex, but

continues along one side of the widening anterior face to the base of the crown. The posterior cutting edge is nearly straight, while the anterior is rather abrubtly curved at the apex.

The anterior and posterior edges are not lateral in position as in *Aublysodon lateralis*.

Measurements.		M.	
		No. 1.	No. 2.
Length of crown		.025	.014
Diameter at base	antero-posterior	.012	.006
	transverse	.0135	.008

A large species. Discovered by Jno. C. Isaac.

Laelaps explanatus, sp. nov.

An abundant species, but as yet represented only by teeth which are about the size of those of the largest of living *Varanidæ*.

The crowns are strongly compressed and curved; one side is flat, the other gently convex; the posterior cutting edge is median and concave. The anterior edge is not continued to the base of the crown, and disappears before attaining the apex; it is feebly denticulate, and only at its convex curvature towards the apex; its course is median. The flat face has a slight bevel to the posterior edge. Surface smooth, without transverse undulations.

Measurements.		M.
Length of crown		.0110
Diameter crown at base	antero-posterior	.0066
	transverse	.0028

Laelaps falculus, sp. nov.

Represented by several teeth of about half the size of those of the last described reptile. They differ in form in several respects, being relatively shorter and stouter, and less sectorial in character. The lateral surfaces are about equally convex, while the anterior face is narrowly obtuse, and without cutting edge. The posterior edge is concave and furnished with a serration of smaller denticles than in the *L. explanatus;* it is median in position.

Measurements.		M.
Length of crown		.0090
Diameter of base of crown	antero-posterior	.0056
	transverse	.0040

Found by Jno. C. Isaac.

Dysganus encaustus, gen. et sp. nov.

Char. Gen.—A large number of teeth exhibit the characters of this genus, which is a peculiar form of herbivorous *Dinosauria*. The crowns are compressed, so that the fore and aft diameter much exceeds the transverse. The body of the crown is a flattened shaft of dentine, one face of which is the denser, and produces the cutting edge. This face is flat or weakly keeled, while there are two other faces uniting at an open angle, thus giving a subtriangular section. On each of these faces is adherent a shaft of cementum-like material of a dense character, whose external face is longitudinally concave. These inclose between them on the median line a deep groove, which expands below into a wide concavity, which appears to be enlarged as the age of the tooth increases preparatory to shedding. The other parts of the base of the crown below the cutting face, are inclosed in a rather thick deposit of rugose cementum, which rises a distance on the sides of the tooth.

The method of replacement of the teeth in this genus appears to resemble that of *Cionodon*, except that there is no indication of the existence of as many series in the transverse direction. The longitudinal grooves in the anterior and posterior cement columns are probably occupied by the borders of the apices of successional teeth. The presence of these columns, etc, distinguishes this genus from that and other allied genera.

Char. Specif.—The cutting face is more or less concave, and is impressed or sunken, its lateral borders, and the cement of the basis, projecting beyond it. The inferior border is also usually oblique, that of one of the sides rising diagonally. In the same proportion, a weak keel is also unsymmetrically placed, lying close to the opposite border, and dividing the face into a wide and a narrow concavity. The oblique border is also incurved, the edge of the posterior cement column curving round the cutting face of the dentine. The latter is delicately rugose in unworn specimens. The external basal cementum rises highest on the incurved border of the crown; its surface is minutely rugose, the rugosity being generally punctiform. It is also of a different color from the dentine in the specimens as preserved, and is occasionally found nearly worn away. The edge of unworn teeth is not serrate.

Measurements.	M.
Length of basis of tooth	.012
Diameter of crown, antero-posterior	.009
Diameter of crown, transverse	.004
Transverse diameter below crown	.008

The teeth are rather smaller than those of *Hadrosaurus foulkei*. The borders present no indication of the crenation seen in that and other species, either in worn or unworn specimens.

Dysganus haydenianus, nov. sp.

Represented by a number of teeth found in such relation that they are supposed to belong to two individuals.

They differ materially in form from those of the *D. encaustus*, and exceed any of them in size.

The base of the tooth possesses the thick investment of rough cementum, and has a slope away from the base of the crown. The form of the crown is peculiar in possessing a lateral face placed at a strong angle to the usual face, and separated from it by a strong protuberant angular ridge. This angular cutting face would resemble that of the *Diclonii* were it not that the body of dentine of which it is composed is a flat plate instead of a triangular segment of a subquadrate prism. Each face has a separate plate, which is separated from the other by a suture. A solid mass fills the angle between them, which is divided by a groove produced by the pressure of the angle of the face of the succeeding tooth which fits it. The wider of the "front" faces is divided by a low longitudinal ridge. Both of the faces are bounded by an external incurved ridge which cause them to have a concave surface.

A tooth of a size equal to that of the one just described was found with it, has a form more nearly like that of *D. encaustus*, in the less degree of prominence of the lateral angle. It displays but a single posterior cementum-like mass, which presents considerable lateral faces as well as a posterior one, as in the first described tooth.

Measurements.	M.
Length of base of crown	.010
Elevation of remaining part of crown	.006
Diameter of crown, antero-posterior	.015
Diameter of crown, transverse, total	.010
Diameter of crown, " dentine	.004

Dedicated to Doctor F. V. Hayden, U. S. Geologist.

Dysganus bicarinatus, sp. nov.

This dinosaurian is represented in the collections by some of the teeth of three individuals. Two of the teeth represent immature stages, while the others are worn by continued use. They all present characters not found in the *D. encaustus*, from which they differ in a direction the opposite of that which characterizes the *D. haydenianus*.

The crowns present a nearly flat face without incurved lateral angles, nor prominent median keel. The basis is wide, projects in a rim beyond the face, and is invested with rough cementum. The face is peculiar in being divided into three planes by two low angular ridges, and its surface is smooth. The dentinal column is triangular, and there are two posterior columns separated by a fissure, in mature teeth.

The absence of the lateral incurved angle, and the presence of the two median ones distinguish this species from the *D. encaustus*.

Measurements.		M.
Length of basis		.009
Width "		.011
Length of worn face		.006
Diameter of crown	antero-posterior	.011
	transverse	.007

Dysganus peiganus, sp. nov.

In the typical tooth of this species the form approaches the genus *Palæoscincus*, Leidy, in the compression of the crown, and the contraction of the base; it is a limital species of *Dysganus* if really properly placed in that genus.

The widest portion of the crown is above the base; from this expansion it contracts in both directions, and in the unworn tooth forms an angular median apex. This is not the case in *D. encaustus*, which is regularly rounded. The margin of the crown is narrowed, expanding but little towards the expansion, and is quite rugose. From these rugosities low ridges descend on the face of the tooth, whose surface is also minutely rugose. The face is divided by a prominent median rib, which extends to the apex. No cementum is visible on the basis, in the only specimen in which this part is preserved.

Measurements.			M.
Length of crown			.008
Diameter of crown	transverse		.005
	antero-posterior	at base	.008
		greatest	.011

Dicloniu pentagonus, gen. et sp. nov.

Char. Gen.—Herbivorous dinosaurians, in which the teeth are elongate and without distinct root, and present dense material only on one side of the crown (the "front"), whose section produces a cutting edge. The other face of the tooth (the "back") is coated with cementum, and is absorbed during the protrusion of the successional tooth from below, which thus rises from "behind." In the antero-posterior direction the teeth are protruded alternately, and the lower parts of the crowns are contracted to give space for the apices of the adjacent young teeth. In the type of the genus there is but a single series of teeth.

In the known species of this genus, the dense face ("front") of the crown presents a longitudinal keel, but this is not necessarily a generic character. The terms "front" and "back" are not intended to be accurate, as the faces so termed are either external or internal, the direction being probably reversed in the two jaws.

This genus is allied to *Hadrosaurus* and *Cionodon*. From the former it differs in the mode of succession of the teeth, which, as determined by Prof. Leidy in that genus, is from the "front" of the base of the tooth, whereas, in *Diclonius*, the succession is as in *Cionodon*, from the "posterior" base of the tooth. This arrangement allows of a more continuous use of the dense face than in *Hadrosaurus*, where that face terminates as the young crown rises into functional position. A species from the Fort Union bad lands of the Judith River was described by Dr. Leidy as *Trachodon mirabilis*. Specimens of this species from the locality furnishing those of *Diclonius*, present the mode of succession ascribed by that author to *Hadrosaurus*, to which genus he afterwards referred the species under the name of *H. mirabilis*.

The dentition of species of this genus shows that but one tooth in mature functional use existed in a line transverse to the axis of the jaw at one time, and that alternating with these, one partially protruded crown, and one stump of a crown, present masticating surfaces in transverse relation. The formula for this genus should then be written 2—1, while in *Cionodon* it is 3—3—2.

The type of this genus exhibits a mode of nutrition of the young teeth similar to that seen in the genus *Saurocephalus* among fishes. The bone is perforated by a series of foramina, each of which conveyed an artery directly into the base of the growing crown.

Char. Specif.—The front of the crown is divided longitudinally by a prominent median keel and the borders are not serrate. The keel is only moderately prominent at the lower part of the crown. The back of the crown is divided into three faces by two straight longitudinal parallel solid angles, and the crown is contracted near the base by the lateral bevels for the adjacent growing teeth All these faces are covered by cementum, whose roughness is granular in character. The external surface of the jaw-bone has precisely the same character, so that the apices of the teeth only appear as prominences of its border.

The typical specimen is that of an individual of moderate dimensions; measurements of a tooth of a gigantic individual are given below.

Measurements.	M.
Length of a series of five teeth	.023
Protrusion of crown of largest tooth	.006
Diameter " " "	.006
Length of crown above lateral apical facets of larger animal	.013
Diameter of crown at same point { antero-posterior	.011
Diameter of crown at same point { transverse	.009
Width of median face of "back"	.005

Diclonius perangulatus, sp. nov.

This abundant species of herbivorous dinosaur has left its shed teeth in many localities of the Fort Union horizon, in company with those of the *Trachodon mirabilis*, *Palæoscincus costatus*, and other large reptiles. Teeth with complete apices are rare. The marked character of the species is seen in the prominence of the median angular ridge which divides equally the cutting face of the crown from apex to base. The prominence increases downwards so that the transverse diameter becomes greater than the antero-posterior, in some cases being diamond-shaped in the transverse direction. Its position is symmetrical, or nearly so. The lateral borders are smooth, one specimen displaying a faint trace of crenation near the apex. There is no shank or root in any of the teeth preserved, and the basis is excavated on the side away from the cutting edge for the apex of the successional tooth. A band of roughened cementum extends round the base, and is continued upwards on each side opposite the cutting face. This side presents three faces, a narrow median, and two wider lateral. The latter are slightly concave, and are probably adapted to the apices

of the successional teeth; the former is often slightly concave, and is the seat of most rapid attrition. The lateral facets disappear at a distance below the apex, where the non-cutting side is strongly convex, and covered with a coarsely rugose cementum; the rugosity including pits.

Measurements.	M.
Length of a shed tooth	.011
Diameter of crown { antero-posterior	.010
Diameter of crown { transverse	.013
Width of facet for successional crown	.006
Width of posterior facet	.005
Width of cutting face of another near apex	.008
Antero-posterior diameter of do. at do.	.010

The prominence of the median angle with other points distinguishes this species from the *Cionodon arctatus*. The size is larger than that of the known specimens of that species, equalling that of the largest of the order. (See Report of U. S. Geological Surv. Terrs. II., 4to. for description of genus *Cionodon*.)

Specimens of this species have been referred by Dr. Leidy to his *Trachodon mirabilis*.

Dicleanus calamarius, sp. nov.

This species, as represented by teeth, is the smallest of the genus, but the adult size is a point, however, not easily determined among extinct reptiles. The teeth are slender, and the front has parallel borders and a median keel. The borders are entire, and, in two of the crowns, twisted slightly round the long axis of the tooth. The keel is thus twisted also, and towards the base, when it becomes quite low, is nearer one border than the other. The back of the tooth displays two lateral facets, separated by a narrow median facet. The former have a thin, delicately rugose, cement investment, with a minute rugosity; the latter is smooth in the specimens, apparently from friction. The characters of this saurian readily distinguish it from its congeners.

Measurements.	M.
Length of portion of crown	.012
Diameter of crown { antero-posterior	.004
Diameter of crown { transverse	.004

Hoplosaurus crassus, gen. et sp. nov.

Char. Gen.—Teeth with obliquely truncate face and distinct root, which is grooved for the successional tooth on the front.

No external cementum layer, caudal vertebræ biconcave, and brim narrow. Fore limbs large and massive.

The teeth of this genus resemble those of *Hadrosaurus*, and like them, are replaced from the "front," an arrangement which precludes the possibility of more than one series of teeth being in functional use at one time. The robust fore limbs and elongate ilium distinguish *Diclonius* from *Hadrosaurus*. From *Trachodon* it differs in the absence of the rough cementum layer on the back of the tooth.

Char. Specif.—The faces of the teeth are acuminate oval in form, and are divided by an elevated keel, which is median above, but turns to one side at the base. Margin crenate, the grooves extending more or less on the convex "back," which is otherwise smooth.

Sacrum with ten vertebræ, the last centrum much compressed, the diapophyses extending horizontally from the neural arch above, and connected by a vertical lamina with the iliac supports; length 27.33 inches. The bones of the limbs are robust, the hinder the longer, but not so much so as in some other genera. Length of femur 22 inches; width, proximally, 7.4 inches; distally 6 inches. Length of tibia 20 inches; greatest diameter, proximally, 8 inches; distally 7.25 inches. The three anterior dorsal vertebræ are coossified, and the first exhibits a deep cup for articulation with the preceding vertebra. The episternum is a T-shaped bone, thin and keeled on the median line below. Length of transverse portion 21 inches.

Paronychodon lacustris, gen. et sp. nov.

Char. Gen.—The teeth which characterize this genus have the general character of those of *Plesiosaurus*, *Elasmosaurus*, etc. The crowns are subconic, and the enamel is thrown into longitudinal plicæ. The special characters of the genus are seen in the form of the crown, one side of which is convex, and the other side plane, so that the section instead of being circular is semicircular. It is also strongly curved in the direction of its plane face.

Char. Specif.—Both anterior and posterior edges are curved, and are not acute nor denticulate. There are four plicæ on the flat face, only two of which approach the apex. There are six keels on the convex face, all of which approach the apex. All the carinæ are rather obtuse, and the enamel is otherwise smooth. The apex is very acute.

Measurements.		M.
Length of tooth		.0130
Diameter at base	antero-posterior	.0040
	transverse	.0024
Length of crown		.0100

It is probable that portions of skeleton of this reptile are in my possession, but the means of positive identification are yet wanting.

Compsemys imbricarius, sp. nov.

This species, like the others of the genus, has the scutal sutures well defined, and the superficial surface of the carapace sculptured. The character of this sculpture distinguishes the species, and in the present instance in a special manner. It consists, in the *C. imbricarius*, of excavations bounded on the sides by a short ridge each, which alternate with each other. Thus each bounding ridge terminates abruptly at the fundus of one of the fossæ, while the other end of the fossa rises and contracts to another ridge. The result is precisely that seen in the interior sculpture of Saracenic domes or niches, and is one which is quite unique among tortoises. The direction of the ridges is at right angles to the costal dermal sutures. This species was about as large as the snapping tortoise (*Chelydra serpentina*).

Measurements.		M.
Thickness of a costal bone		.0050
Three fossæ measure	lengthwise	.0065
	crosswise	.0050

Compsemys variolosus, sp. nov.

One of the most abundant, and the largest species of the Fort Union beds. The carapace is convex and the plastron flat; the marginal bones are heavy and strongly convex on the inferior side. The margin of the plastron is thickened and heavy, characters which also belong to all parts of the carapace. The sutures of the dermal scuta are deeply impressed, and the surface of the bone is strongly sculptured above and below, and even on the superior face of the thickened margins of the free lobes of the plastron. The sculpture consists of round fossæ, which are deeply impressed and are arranged quincuncially, so that their borders never form straight lines. The latter are also more or less angulate on the edge, so that the surface has a more than usually rugose character.

The typical specimen equals those of the large land tortoises of the Eocene in dimensions.

Discovered by C. H. Sternberg.

Polythorax missuriensis, gen. et sp. nov.

Char. Gen.—Plastron with contracted fixed lobes and wide bridge; carapace with well-developed marginal bones; mandibular ramus narrow; alveolar face with acute external margin; the symphysis neither produced nor recurved. Dermal scuta everywhere distinct, those of the plastron the usual ones, with the addition of the two marginal intergulars, and two large interhumerals. The latter scuta are separated from the humerals by sutures running parallel with the humeral margin of the anterior lobe between the gular and pectoral scuta.

In the possession of interhumeral scuta, *Polythorax* differs from any known genus of *Testudinata*. The general structure is much like that of *Adocus* and *Baëna*, with nearer resemblance to the latter in its double intergular scuta. It is impossible to ascertain whether there are intersternal bones, as the plastron is coössified throughout. The presence or absence of intermarginal scuta cannot yet be determined, although it is clear, that if existing, their position is quite external.

This genus is interesting as connecting in its stratigraphical position allied types of Cretaceous No. 5 (*Adocus*), with those of the Wahsatch and Bridger Eocenes (*Baëna*).

Char. Specif.—Carapace with openly dentate posterior border. The surface is irregularly swollen, especially on the median line near the margins of the vertebral scuta. The vertebral scuta are wide, the costals short, and the marginals narrow. The anterior lobe of the plastron is a little shorter and more contracted than the posterior; its base is narrower than the antero-posterior extent of the bridge. Its extremity is rounded, while that of the posterior lobe is truncate with rounded angles. The gular and intergular scuta are each wider than long, while the interhumerals are much longer than wide. The humerals are narrow, while the pectorals are wide from the anterior position of the pectoro-humeral suture. Each anal scutum is longer than wide.

The surface of the plastron is obsoletely but coarsely rugose; the roughness greatest anteriorly, where it consists of short raised lines irregularly disposed.

Measurements.	M.
Length of plastron	.183
Length of anterior lobe	.049
Length of bridge	.076
Width of bridge	.076
Width of extremity of posterior lobe	.035
Thickness at inguinal region	.010

Hedronchus sternbergii, gen. et sp. nov.

Char. Gen.—The bone on which this genus reposes has the appearance of the crown of a young tooth. Its central cavity is large and expands to the margin of the basis; its apex is unworn. It appears to be too protuberant for the position of a dermal tubercle. It may be distinguished as a short crown on a shorter slightly constricted portion or neck. The crown culminates in three crests, which together form a letter T, and which descend towards the neck. There is no investment of enamel or cement, and the material of which it is composed resembles dense bone.

Char. Specif.—The faces on each side of the stem of the T, are concave and divided by an oblique crest, which descends from the common apex. The other face is gently convex, and the inferior part of each of its bounding crests projects ear-like. The base is an oval.

Measurements.		M.
Elevation of crown		.006
Diameter of base	longitudinal	.005
	transverse	.004

Discovered by Charles H. Sternberg.

Ceratodus cruciferus, sp. nov.

A basal lamina separable from the dentigerous lamina. The latter supports ribs which diverge from a single marginal rib which extends along one side. The marginal rib is separated by a deep groove from the radiating ribs, which is continuous with the grooves between the latter. The ribs are of irregular diameter and not perfectly straight; they are interrupted by weak transverse ridges which project beyond the margins. The ridges rises abruptly from their common base and are separated distally by notches of the margin.

Measurements.	M.
Long diameter of dental surface	.011
Short diameter of dental surface	.007
Thickness of plate	.003

There are six ridges in the length.

Ceratodus hieroglyphus, sp nov.

This species is materially different from the last, and was more abundant, judging from the occurrence of its remains.

The dentigerous plate is thin and dense, and has the appearance of a short toothed comb with a handle. The tooth-like points are the extremities of low ridges, which are arranged nearly at right angles to a wide longitudinal elevated half of the osseous base. They are separated by shallow grooves from each other, and are not continuous with the basis just mentioned, which rises abruptly above them. They are smooth. The "handle" above alluded to is triangular in section having two bevels on the side supporting the tooth ridges. The lower face of the bone is smooth.

Measurements.	M.
Total length	.013
Length of dentigerous portion	.010
Total width	.0045
Width of dentigerous portion	.0020

There are thirteen teeth in the length.

Myledaphus bipartitus, gen. et sp. nov.

Char. Gen.—Crowns of the teeth molar in character, truncate, wider than long, standing table-like on the root. The latter partaking of the shape of the crown, short, straight, split equally and at right angles to the greatest diameter of the tooth. The crowns form a pavement having a regularly hexagonal outline. Their composition is different in the halves on each side of a line which divides the crown equally, running in the long direction. On one side the dentine is striate at right angles to the long diameter; the structure is not distinguishable by the hand lens on the opposite side of the line.

The affinities of this genus cannot now be stated, but the form of the root recalls the *Elosmobranchii*, and that of the crown, some of the rays.

Char. Specif.—The staining on opposite sides of the line that divides the crown, is different, on the one paler than on the other.

The face of the crown is nearly plane, and its border is vertical and overhangs the root all round in a narrow ledge; it is vertically striate, as is also the root. The antero-posterior diameter exceeds the transverse, and the facets are subequal, and are continued less perfectly on the root. The fissure of the latter does not reach the base of the crown.

Measurements.	M.
Length of tooth	.0053
Diameter of crown { antero-posterior . . .	.0060
Diameter of crown { transverse	.0045
Long diameter of root	.0050
Length of root	.0030

Discovered by Charles H. Sternberg.

NOVEMBER 7.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

A paper entitled "Notes on American Cretaceous Fossils, with descriptions of some New Species," by Wm. M. Gabb, was presented for publication.

On Conglomerate No. XII.—Mr. YOUNG described the Conglomerate No. XII. as it appears upon the New River in West Virginia.

The formation consists of alternate members of shale and sandstone; the latter numbering five, which are massive, but not conglomeritic, and form cliffs upon the sides of the hills which flank the river.

The shaly members of the group contain workable coal-beds. There are four beds, ranging in thickness from three to five feet. Small seams are also present.

The total thickness of the formation is about one thousand feet, half of which is represented in the sandstone cliffs.

The formation as above described extends from Hinton to Hawk's Nest, the latter point being a bold cliff formed of one of the sandstone layers of the formation.

The New River at Hinton falls over a barrier made by one of the sandstone members.

The falls of the Kanawha are made by the upper plate of the conglomerate.

The Australians.—Dr. PICKERING, having recently made a communication to the Academy on the sources of the native population of New Zealand and Tasmania, now proposed to speak of Australia.

The zoological character of Australia precludes the origin there of a member of the human family, and the Australians are intruding strangers; but where they come from is a mystery.

The most prominent photographs at the Centennial Exposition are unsatisfactory, with the exception of two life-sized heads of clearly pure-blooded natives; while the many excellent small photographs require closer inspection than is usually afforded to visitors.

At the Fiji Islands, he had been informed by a chief of the existence of "long-haired" people in the interior of the main island; similar accounts are given of other large islands westward, and there are inland people in the Malayan archipelago about whom very little is known; yet it does not seem probable that

any island in the whole series in question contains straight-haired blacks resembling Australians.

Though unprepared to cancel the Australian as a distinct physical race, he admits that affinity may possibly be found in the Telingan or Black Hindu; and, notwithstanding the general Caucasian features of Telingans, and the broad, flat nose and darker complexion of Australians, a match could probably be found of individuals not very dissimilar in personal appearance.

From eastern Hindustan, Telingans continue migrating by thousands to the Malayan archipelago, but, being all males, make very little impression on the resident population. He did not, while among them, apply the Caucasian test of the divided cartilage at the nasal extremity.

On Sonomaite.—Mr. E. GOLDSMITH stated that he had found among other undetermined minerals collected by Prof. F. V. Hayden in Sonoma County, Cal., near the geysers, one for which he proposed the name Sonomaite.

This is the composition of the first specimen—

$\dot{A}l$	= 7.66	per cent.	= 3.56	per cent.	oxygen.
$\dot{F}e$	= 2.01	"	= 0.46	"	"
$\dot{M}g$	= 7.14	"	= 3.21	"	"
$\ddot{S}$	= 38.78	"	= 23.26	"	"
$\dot{H}$	= 44.41	"	= 39.55	"	"

A second specimen from another spot probably, but from the same locality, gave but a slightly different result, as the analysis showed—

$\dot{A}l$	= 8.36	per cent.	= 3.89	per cent	oxygen.
$\dot{F}e$	= 1.56	"	= 0.34	"	"
$\dot{M}g$	= 7.51	"	= 3.00	"	"
$\ddot{S}$	= 38.30	"	= 22.98	"	"
$\dot{H}$	= 44.27	"	= 39.35	"	"

The oxygen ratios of both analyses are—

$\dot{A}l$	:	$\dot{M}g$ ($\dot{F}e$)	: $\ddot{S}$	: $\dot{H}$.
3	:	3	: 18	: 33.

which result may be expressed in the formula—

$$\dot{A}l\,\ddot{S}_3,\ 3\dot{M}g\,\ddot{S} + 33\dot{H}.$$

The alumina was in these analyses precipitated twice in order to effect a complete separation of the magnesia. The water was found by the difference.

In regard to the oxidation of the iron, he ascertained that, if the watery solution of the salt was tested with a solution of sulphocyanide of potassium and well mixed, no red coloration appeared, but, on adding a few drops of diluted sulphuric acid, a reddish coloration became visible. It seems reasonable to assume that a small quantity of the iron was oxidized to sesquioxide, but had no acid with which to form the sesquisalt. The truth of this view becomes apparent if a few hundred milligrammes are dis-

solved in much water, in which case a small quantity of sesquioxide of iron drops to the bottom of the vessel; if, however, the solution of the salt is concentrated, the separation of this oxide seems not to take place. The iron in this mineral varies in quantity, and he thought it might at times be entirely wanting, for magnesia and protoxide of iron may substitute each other, and for this reason he did not introduce it into the formula.

When he first determined the mineral, it was supposed to be Pickeringite, because the general appearance, the reactions with the blowpipe, its solubility, and all the elements contained in it are the same; only the quantitative analysis showed the differences in the ratios of the constituents.

Sonomaite occurs in silky, colorless crystals.

Specific gravity in alcohol of 95 per cent. = 1.982; in water it would therefore be = 1.604.

Klauer described (Gmelin's Handbuch der Chemie, 2, 315) a salt which differs from this only in having 3 æq. of water more.

Explorations in South America.—Prof. COPE stated that an expedition had been planned in this city for the exploration of the sources of the Madeira River, and of the eastern slopes of the Andes in Bolivia. Prof. James Orton had taken charge of the party, which included a corps of scientific assistants. As the region in question is the least known in South America, important results are anticipated. It was hoped that the Academy would be able to avail itself of these in the increase of its collections, etc. The expedition sailed on the 25th of October last.

NOVEMBER 14.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

A paper entitled "Note on a Cirripede of the Californian Miocene, with remarks on Fossil Shells," by T. A. Conrad, was presented for publication.

On Boussingaultite and other Minerals from Sonoma County, California.—Mr. E. GOLDSMITH stated that among the minerals brought by Dr. F. V. Hayden from Sonoma County, Cal., was one which he thought proper to call Boussingaultite. Although he had not been able to find in the current literature an analysis of the mineral to which Bechi had given this name in 1864, still he presumed that it might be that. It is stated, however, in Dana's Descriptive Min., p. 635, that Boussingaultite is mascagnite with some sulphate magnesia; whereas the mineral which Mr. G. analyzed seems to be sulphate magnesia ammonia. The

mineral occurs in irregular granular masses, is soft, and easily rubbed to a perfectly white powder.

If heated in the tube, closed at one end, it affords water and a white sublimate, which latter is sulphate ammonia; in the bottom remained a white residue. On coal it gave, with solution of cobalt and strong ignition, the reddish coloration indicating the presence of magnesia. It is soluble in water. The solution showed the presence of sulphuric acid, magnesia, and ammonia.

The quantitative determination of the sulphuric acid and the magnesia was done with the air-dry substance; the amount of ammonium-oxide and water were calculated by means of those obtained data stöchiometrically.

S̈	=	38.86	per cent.	=	23.31 oxygen.
Mg	=	15.56	"	=	6.22 "
AmO	=	5.03	"	=	1.54 "
Ḧ	=	40.55	"	=	36.04 "

The oxygen ratios of the acid and bases are—

S̈	:	Mg	:	AmO	:	Ḧ.
15.13	:	4.03	:	1	:	24.

Here are evidently five equivalents of sulphuric acid, and also the same number of equivalents of bases, hence the formulated expression—

$$4\dot{M}g\,\ddot{S},\ AmO\,\ddot{S} + 24\dot{H}$$

may be proposed.

The substance is nearly insoluble in alcohol of .818 specific gravity, at 70° F., it was therefore weighed in it, and its specific gravity found to be = 2.037; in water it would have the specific gravity = 1.666.

Mr. Goldsmith further called attention to the following minerals, which were all collected by Prof. Hayden in the same locality as those described above:—

Geyserite intermixed with a basic sulphate of iron and an oil, which is probably petroleum.

Epsomite or native sulphate magnesia occurs there, sometimes pure, occasionally mixed with geyserite.

Geyserite containing some sonomaite.

Mascagnite or native sulphate ammonia in white, irregular-shaped fragments.

Nodular geyserite seems to have been ground by the action of the motion of the geyser. Some of the nodules are nearly spherical; others spheroidal; a few in the collection are flattened, but always smoothly rounded; color white. They are nearly pure silica.

Sulphur is also a product of the geyser region. This element was noticed to be in very small crystals, which, when burned away, left at first a black carbonaceous matter; on heating to a high temperature, the carbon disappeared and a white ash remained.

Iron ochre containing a small quantity of arsenic. The reddish-brown powder has a peculiar disagreeable odor.

Kaolinite in the form of a pale blue, soft powder; on heating, the blue color disappears; if this substance is heated in the glass-tube, closed at one end, water is expelled which reacts alkaline; but on heating strongly, that is, to near redness, the reaction on litmus-paper indicates the presence of an acid.

Earthy geyserite containing some gypsum, and, at least, the flame-reaction of the presence of a minute quantity of potassa.

Although Mr. G. searched for chlorine or soluble chlorides, which as usual are widely distributed over the globe, in these cases, however, they seem to be absent. Whether in Sonoma County no chloride of sodium is found cannot be said at present with certainty; it is singular that none was noticed among those minerals which he had the opportunity to determine.

Cretaceous Vertebrates of the Upper Missouri.—Prof. COPE stated that he had recently returned from an exploration of the Judith River beds of the Upper Missouri, which were discovered by Dr. Hayden in 1855. Attention was given to the relation of this formation to the underlying marine cretaceous beds, and to the respective faunæ of the two as compared with that of the early eocene period. The fauna was found to be terrestrial and lacustrine, including great numbers of *Unionidæ*, *Lepidosteus*, *Myledophus* (a form probably of rays); of tailed *Batrachia*, crocodiles, fresh-water turtles, *Rhynchocephalia*, and Dinosaurian reptiles. The *Dinosauria* constitute the most abundant and characteristic form of life, eighteen species having been found, of which eight were of the carnivorous (*Goniopodous*) and ten of the herbivorous (*Orthopodous*) type. The predominant genus of the former is *Lælaps*, and of the latter *Dysganus*, of both of which several species were found.

The facies of this fauna is thus plainly mesozoic and cretaceous, adding weight to the arguments already adduced to this effect. But the change from the fauna of the underlying cretaceous numbers four and five is very striking, the genera and often higher groups being quite different. The types of the marine beds were found to be *Pythonomorpha*, *Elasmosaurus*, a genus allied to *Polycotylus*, *Enchodus*, chimærids, and sharks, with marine *Cephalopoda*, etc. Nevertheless, the physical transition between the marine and lacustrine formations appears to be complete, as indicated by Prof. Hayden.

Dr. Le Conte read the following report from the committee appointed, at the request of the Centennial Commission, to investigate and report upon the introduction of noxious insects and plants through the medium of the foreign exhibits in the exhibition:—

REPORT ON INSECTS INTRODUCED BY MEANS OF THE INTERNATIONAL EXHIBITION.

On behalf of the Committee appointed by the Academy of Natural Sciences of Philadelphia, at the meeting held October 10, 1876, "to investigate and report upon the introduction of new species of insects and plants through the medium of foreign exhibits at the Centennial Exhibition," I have the honor to present the following report, with the desire that it may be forwarded to the proper authorities of the Centennial Commission, at whose instance the Committee was appointed.

The Committee is composed of the following members of the Academy:—

Dr. Joseph Leidy, Dr. George H. Horn, Mr. Thomas Meehan, Dr. J. Gibbons Hunt, and Dr. John L. Le Conte, Chairman.

It was apparent that while the labors of the botanists of the Committee could not properly commence until next spring, when careful observation will recognize any new introductions of plants, the entomological investigations should be made as speedily as possible. Accordingly, Dr. Horn and myself, availing ourselves of the admission cards which had, with great liberality, been sent to the members of the Committee, went frequently to the exhibits in the Main Building and Agricultural Hall, and made collections in all the agricultural products from foreign countries, which were found to be infected.

Most of the species which we obtained have been already distributed over the globe by the ordinary channels of trade, and nothing is to be apprehended from the addition of a few hundred thousand specimens, to the incalculable millions of individuals of the same kind, that we have now domiciled amongst us.

I am happy to add that the species found, which have not been previously observed in the United States, will be innocuous; they are dependent for their support upon plants which do not grow here, and which would be of no commercial value to us if they were cultivated.

I may therefore announce, with moderate certainty, that no evil result will occur to our agricultural interests, from any introduction of foreign insects, by means of the Centennial Exhibits.

Before concluding this report, by a list of the insects collected in the buildings, it is our duty to notice some remarkable differences between the exhibits from different countries, indicating the care with which the specimens had been prepared, and the means taken to prevent depredation by insects.

All those exhibits which had been moist when packed, or had become moist or mouldy on the voyage or during the Exhibition, abounded in *Bruchus*, *Calandra*, and *Tineidæ;* while those which were protected against moisture were unattacked. It stands to reason, in fact, that insects dependent on a circulating fluid for their vitality, and having, during their early stages as larvæ, a very soft and moist body, cannot obtain in properly dried grains the requisite amount of moisture for their sustenance, and the egg, if previously deposited, will remain, like an ungerminating seed, for a favorable moment to develop, or if hatched, the larva will die at an early stage.

It was, therefore, with great pleasure that we recognized the appreciation of this almost self-evident proposition by the Department of Agriculture of Portugal. The exhibits in bottles were entirely free from all mould and infection, and in each bottle was a small quantity of caustic lime,[1] wrapped in paper, which, by its hygrometric power, had kept the specimens perfectly dry.

We do not intend to have it inferred, from what is above stated, that all the other exhibits were in a condition inferior to that of Portugal; on the contrary, many of them, as well as many from our own States, were in most admirable order; but, so far as we could learn, this good condition had been produced by great personal care, and the removal from time to time of the infected parts; not by the use of a preventive agent.

While investigating the occurrence of a small species of *Tineide* in the Italian exhibit of Leghorn straw, I learned that some importations of straw goods, by Messrs. Albinola and Bailey, of New York, had been attacked by insects. I immediately wrote to those gentlemen, who, with great courtesy, sent me two collections of the insects infesting a recent importation which had become mouldy from being packed in a moist condition. The names of the species contained in this set are appended; they are all either carnivorous or fungivorous, and can therefore do no harm; some of them have

[1] The nature of the powder was suspected by the Committee, but the determination was made through the analysis of Mr. Edward Goldsmith.

not been before observed in the United States, or their habits have not been noted. What is more important, however, is that none of the straw goods were attacked by moths either on this or previous occasions. It is therefore to be inferred that the moth in the Italian exhibit was the grain-moth of the seed of the grass which produced the straw used in the manufacture of the Italian goods. What confirms this inference is that the moths occurred in but one case, in which were exhibited several bunches of the straw with the heads of grain still remaining.

Prof. C. V. Riley, in the Proceedings of the Academy of Science of St. Louis, Oct. 2, 1876, has given a list of the species which he collected at the Centennial Exhibition, with very useful and suggestive remarks. We have obtained specimens of all the species mentioned by him except one Crambide Lepidopteron, from the Egyptian exhibit, for which we sought without success. At an earlier period in the season, and with smaller attendance of visitors, the number of species in our list would perhaps have been larger, but no additional advantage would have been obtained therefrom. The species, with the few exceptions noted, are either innocuous or previously introduced.

J. L. LE CONTE, *Chairman*,
GEO. H. HORN,
JOSEPH LEIDY.

List of Species collected in the Centennial Buildings in Foreign Exhibits.

COLEOPTERA.

Silvanus surinamensis.

Argentine Confederation and Brazil, in various materials.

Lemophlœus ferrugineus.

In beans, Brazil. These two species lived upon the debris of *Bruchus*, and were accompanied by a species of *Psocus*.

Bruchus picturatus, *Fahræus*.

Argentine Confederation; in seeds of two Leguminous plants, one of which produces a screw bean, resembling *Strombocarpus* of Arizona.

Bruchus, sp.

Allied to *B. prosopis*, of Arizona and New Mexico. Argentine Confederation; also in the screw bean. These two *Bruchi* are depredated upon by three small species of Ichneumonidæ.

Bruchus, sp.

Of larger size and more uniform color. Argentine Confederation, in the seeds of another Leguminous plant, allied to *Prosopis*.

Bruchus, sp.

Of larger size and more mottled color; in the seeds of three other Leguminous plants of the Argentine Confederation.

Bruchus scutellaris.

Venezuela, in beans.

Bruchus obsoletus.

In beans from various countries of both continents.

Bruchus pisi.

In peas; Spain and Portugal.

Bruchus, sp.

A small broad species, with transverse prothorax; ♂ rather uniformly clothed with gray-brown pubescence; antennæ as long as the body; ♀ black, with a grayish-brown broad dorsal stripe on the prothorax, and a small transverse white band on each elytron, extending from the side margin nearly to the suture, a little in front of the middle; thighs not toothed. Length .09 inch.

Brazil, in a bluish-gray variety of bean. I cannot identify this species among those described in Schönherr's work; it is of the same form, and belongs to the same division as *B. pisi*, but is much smaller, and quite different in other characters. It is the only one of the species here mentioned which is capable of being introduced; and I have, therefore, given such a description as will enable it to be recognized. The antennæ are only feebly serrate. This species is mentioned by Mr. Riley as *B. granarius*, but it does not agree with the figure of Olivier.

Rhizopertha pusilla.

Victoria, Australia; in wheat. This insect has been previously introduced into the United States in Persian wheat, distributed by the Patent office. (*Vide* Lec. Class, Col. N. Am. p. 208.)

Calandra oryzæ.

This destructive insect abounded in exhibits of corn (maize), wheat, and rice from every part of the globe. I also observed it in arrowroot from Brazil.

Araeocerus coffee.

Eating the thin shell of cacao-nuts from Brazil, but apparently not attacking the interior of the nut. Previously introduced both in the Atlantic and Pacific States.

LEPIDOPTERA.

The ordinary and well-known *Tineidæ*, which affect wheat and corn (maize) (*Butalis cerealella*, *Ephestia Zeæ*), abounded in exhibits from various countries. There was a smaller form which is mentioned above, as coming from the grass seeds of the Leghorn straw. Specimens have been identified by Prof. C. V. Riley as the common grain moth, *B. cerealella*.

HYMENOPTERA.

Besides the three *Ichneumonidæ* parasitic on the *Bruchi* in the Argentine Confederation exhibit, I observed a small species of *Pteromalus* parasitic on the *Tinea*, *Bruchus obsoletus*, or *Calandra oryzæ* which infested a small bag of Brazilian wheat.

List of the Species found in Mouldy Specimens of Straw Goods from Italy.

These species were collected by Messrs. Albinola and Bailey, in New York. They are either carnivorous or fungivorous; those of the latter kind live upon the mould, which, as determined by Dr. J. G. Hunt, is a species of *Aspergillus*, previously known in this country.

Lathridius filiformis.

Lathridius striatus.

Cortiearia, sp.

(Not identified.)

Heteroparamecus singularis.

Has not been previously observed in the United States.

Silvanus surinamensis.

Silvanus advena.

Leucophlœus ferrugineus.

Hermidius ovalis.

Habits not previously observed in the United States, though its occurrence was known.

Rhizophagus ferrugineus.

NOVEMBER 21.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

NOVEMBER 28.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-three members present.

A paper entitled "Notes on Fishes from the Isthmus of Panama, collected by Dr. J. F. Bransford, U. S. N.," by Theodore Gill, was presented for publication.

Louis F. Benson and Walter H. Ashmead were elected members.

Dr. A. S. Packard, of Salem, Mass., W. H. Holmes, U. S. Geol. Surv., and Laurenço Malheiro, of Lisbon, were elected correspondents.

The following papers were ordered to be printed:—

NOTE ON A CIRRIPEDE OF THE CALIFORNIA MIOCENE, WITH REMARKS ON FOSSIL SHELLS.

BY T. A. CONRAD.

BALANUS.

B. Estrellanus, Con.

This fossil of the Californian Miocene, *Tamiosma gregaria*, Conrad. I supposed at one time to be a member of the *Rudistæ*, and I also described it as *Balanus estrallanus;* but not satisfied that, as one of the *Rudistæ*, it should be in the Miocene formation, I have further studied its characters, and now conclusively refer it to the *Balanidæ*. The only difference I can find to distinguish it, except specifically, from other species of the genus *Balanus* is that its basis is filled the entire length with septa. These septa do not essentially differ from those of *Balanus lævis*, Brug. In the only specimens found, the opercular valves are wanting, but a portion of the basis on which they rested is well preserved, and shows the same kind of surface as in other *Balani*.

HELIX.

H. Strangulata, Adams.

A very perfect specimen of this species is in the collection of the Academy of Natural Sciences, which I obtained at Yorktown, Virginia, while collecting Miocene fossils at that locality, although I do not recollect whether I found it in the marl or on the surface, probably the latter. It cannot be proved to be a Miocene fossil.

INOCERAMUS, Sow.

This genus is distinguished from *Haploscapha* (*Catillus*, Brong.) by a straight hinge line and the crenulations on the hinge, partly internal; while *Haploscapha* has an irregular or waved hinge, the right valve being alate about the beaks and having a sinus posteriorly, as represented in D'Orbigny's figure, pl. 412, of his "Paleon. Franc." The ligament is wholly external, situated in crenulations more numerous than in *Inoceramus*, and often in an irregular line. Pictet describes *Inoceramus* as "lamelleux," and says "La principale différence qui existe entre

ces coquilles et celles des Inocérames consiste dans la structure du test, qui chez les Catillus est fibreux dans sa couche externe, repellant presque celui des TRICHITES." Mr. Meek adopts *Catillus* as a subgenus of *Inoceramus* without stating a distinguishing character, but I cannot find one species of *Catillus* among those he describes as species of it excepting *I. deformis*. One characteristic difference between the two genera is the extremely thin shell of *Catillus* over the middle portion of the disk and the gradual thickening towards the margin; indeed, the shell of the two species I have described is so thin that it has only been preserved entire by the adhesion of multitudes of *Ostrea congesta* on the back. This thinness is not in consequence of any loss of the original test, for the pearly layer is well preserved. Dr. C. A. White has given a figure of *I. deformis*, Meek, which is a true *Catillus*, as a section of the shell shows. "Report upon Geog. and Geolog. Explor., pl. xv., fig. 1." Catillus attains a far larger size than *Inoceramus*, and is known only in the chalk. Although the interior of the valves is well preserved, no trace of a muscular impression is seen. The laminated structure of *Inoceramus*, where the shell is preserved, will readily distinguish it from the coarsely fibrous structure of *Haploscapha* (*Catillus*).

The latter originated near the close of the chalk period, while the former is found in the lias as well as in the chalk.

APHRODINA, Conrad.

Mr. Meek makes this cretaceous genus a subgenus of *Callista*, which I think an error. *Callista* did not exist in the cretaceous period, nor *Dosiniopsis*.

IDONEARCA, Conrad.

I make the same objection to Mr. Meek's retaining this cretaceous genus as a subgenus of *Cucullæa*. It is a large group of fossil shells, which can be instantly known by the hinge character, and which disappeared entirely at the close of the cretaceous period.

MUTELIDÆ.

HAPLOTHÆRUS.

This extinct genus was the forerunner of *Columba*, Lea (*Leila*, Gray), to which it is nearly allied, the typical species having much

resemblance in outline to *Columba Blainvilleana*, Lea, but wants the cardinal tooth of that genus. The hinge more nearly resembles that of *Columba (Leila) castelnaudi*, Hupé, but the anterior muscular impression is very different from that of *C. castelnaudi*. *Columba*, Lea, takes precedence of *Leila*, Gray, according to date of publication.

ANCHURA.

In the Geology of North Carolina, by Prof. Kerr, I have inadvertly referred *Anchura pennata*, Morton, to his *Rostellaria rostrata*, pl. 2, fig. 28. *Arene Carolinensis* of the same work is erroneously referred to plate 2, fig. 19. It should be pl. 1, fig. 19.

ETEA, Conrad.

To this genus must be transferred *Crassatella monmouthensis*, Gabb; *C. transversa*, Gabb; *C. Delawarensis*, Gabb; and *C. prora*, Con.; all of which were described from casts without knowledge of the hinge characters.

NOTES ON AMERICAN CRETACEOUS FOSSILS, WITH DESCRIPTIONS OF SOME NEW SPECIES.

BY W. M. GABB.

After fifteen years, during which I have been engaged constantly at other geological and palæontological labors, but have not lost sight of my first love—the Cretaceous fossils of the Atlantic region of the United States—I have spent much of the past summer in reinvestigating them. In this work I have been materially assisted by the constantly enriching collection of the Academy, and have received a large suite of fossils from Dr. Little, the State Geologist of Georgia. Besides these, Prof. Cook, of New Jersey, has loaned me all of the specimens from his survey collection that I required, so that I have it in my power, while describing a number of new forms, to correct many of my own juvenile errors, as well as similar ones of others, which must result during the publication of a large number of small, isolated papers. Many of the fossils of New Jersey are only known as internal casts in the marls, and, while very unsatisfactory, require names, if only provisional ones, to assist the field geologist in the identification of strata. Some of these have from time to time been rediscovered in the gray marl, commonly known as the "Ripley group," and we may reasonably hope that all will eventually be fully described. This Ripley marl is a deposit now known to extend from New Jersey around through the coast States to Tennessee. It has been found in all of these States except Delaware, Maryland, Virginia, and South Carolina, that is to say, it seems coextensive with the Atlantic Cretaceous. It is a fine-grained, gray material, in which, unlike most of the rest of the formation, the shell substance is preserved, and, although the shells are often distorted, their specific as well as generic characters are beautifully preserved. It is especially favorable for the study of the bivalves, since, in nearly all cases, the hinges can be exposed. The fossils are extremely fragile, alike from the softness of the inclosing material and from the fact that the animal matter seems to have totally disappeared, without being replaced by any other cementing substance. Still, with care, the greater part of the fossils can be extracted and afterwards hardened with gum,

so as to fit them for study and preservation. In the following paper I have enumerated all the recognizable species sent me by Dr. Little, since very little is known of the fossils of Georgia, and in that sense this is a geographical list:—

NAUTILUS, Linn.

N. Bryani, n. s.

Shell discoidal, sides flattened, nearly parallel; dorsum regularly rounded; umbilicus small; aperture elongate, emarginate to about a third of its length by the preceding whorl; siphuncle central, small; septa slightly arched forwards, close to the umbilicus, and very gently backwards on the middle of the side of the whorl. Surface unknown.

Greatest diameter 3.5 inches; width of aperture 1.9 inch; height of mouth from umbilical margin 2 inches, from the dorsum of included whorl 1.4 inch.

From the yellow Cretaceous limestone of Vincenttown, New Jersey. Two fragments, one comprising half of a volution, well preserved, showing seven septa; the other, a smaller fragment of a larger specimen, useful only as confirming the specific determination.

This species is markedly distinct from *N. Dekayi*, the only other described species in New Jersey. Its flattened sides are entirely unlike the globose form of that species. It seems nearest to *N. Sowerbianus*, D'Orb., resembling that species in the size of its umbilicus and in the style of the septa, as well as in being compressed. But our species differs in having the sides more parallel, in the whorls increasing somewhat less rapidly in size, and in the septa being further apart and less sinuated throughout. I take great pleasure in dedicating it to my friend, Colonel T. M. Bryan, who has, by his assiduous collecting, added much to our knowledge of the New Jersey fossils.

N. sp. indet.

I have also received from Col. Bryan another form from the dark marls of New Jersey, near Vincenttown. This is distinct from either of the known species, having very sinuous septa. It is represented by fragments too imperfect for description.

N. Dekayi, Morton.

Synopsis Cret. p. 33, pl. 8, f. 4; pl. 13, f. 4.

A distorted specimen from Pataula Creek, Georgia, from Dr. Little.

N. elegans, Sby.

It is not improbable that the shell referred by me (in the Report of the Palæontology of California, vol. 1, p. 59, pl. 9, fig. 3) to *N. Texanus*, Shumard, may prove to be Sowerby's species. It seems to agree quite closely, not only in its outline and proportions, but in the shape of the septa and in the ornamentation. The only difference I can detect is that, in the Californian shell, the ribs are a trifle larger and less numerous—a very unreliable character in these shells. Dr. Shumard's species, only known to us by a description from imperfect specimens, may also have to be put down as a synonym.

AMMONITES, Brug.

A. placenta, Dekay.

Ann. N. York Lyc. vol. 2, pl. 5, f. 2.

A large specimen from Pataula Creek, Georgia.

A. Trinitensis, Gabb.

A. Gibbonianus, Marcou, Geol. N. A. p. 35, pl. 2, fig. 2; *not id.*, Lea, Trans. Amer. Philos. Soc., 2 ser. vol. 7, p. 254, pl. 8, f. 3.

In my paper on the fossils of South America, now going through press (Journ. Acad. 1876), I have pointed out the differences between the Texan fossil and that from South America, and I now propose the above name. Marcou found his specimen on one of the tributaries of the Trinity River, Texas.

HAMITES, Park.

H.? torquatus, Morton.

Syn. p. 45, pl. 15, fig. 4.

A straight fragment, with the *Ammonites placenta*, some three inches long. I have it also in my collection from Uniontown, Ala., showing part of the septum.

FUSUS, Lam.

EXILIFUSUS. New subgenus.

Shell very long, slender, fusiform, spire high; aperture produced into a long, slender, twisted canal.

This group differs from the true genus Fusus, as restricted, by its twisted, slender canal. In this character it approaches some of the *Neptuneæ*, but its high spire and strongly costate whorls show that it is more nearly allied to the true Fusus. *Exilia* of Conrad (Journ. Philada. Acad., 2 ser., vol. 4, p. 291) has a

"beak perfectly straight," and may be only an extremely slender *Fusus*. The author does not describe the shape of the outer lip, and gives us no clue as to its family relations, whether it belongs with the *Fusinæ* or the *Pleurotomidæ*. The lines of growth on my shell are slightly sinuous on the upper part of the body whorl, though not enough to be called the notch or sinus of a *Surcula*, the genus which it most resembles in that family. I attribute their shape to the generally curved outline of all of the body whorl.

The figure of *Fusus Diaboli*, Pal. Cal. v. 1, pl. 18, fig. 35, is a very accurate reproduction of one specimen before me, the extremity of the canal being broken away. But I have another, nearly of the same size, with the same character of the spire, in which the aperture and canal are larger than the spire, the canal being twisted exactly as in the present described species. In the specimen figured, as above, the lines of growth are slightly sinuous also, so that further research may prove that this is really a member of the *Pleurotomidæ*.

F. (E.) Kerri, n. s. Pl. 17, f. 1.

Shell elongate, slender; spire high; whorls about six or seven, rounded on the sides and bordered on the upper margin by a rib adjoining the suture. Surface marked by about a dozen oblique heavy ribs, beginning on the top of the whorl adjoining the marginal thickening, most prominent on the upper angle of the whorl, and disappearing a little below the middle. In addition to these characters, their entire surface is covered by numerous closely placed, fine, revolving ribs. Upper part of the aperture subelliptical, continued below into the twisted canal, twice as long as the upper portion. Columella thickened and marked by a comparatively prominent angle, similar to that of *Busycon*, where the curved canal begins.

Length 1.25 inch; width 0.37 inch.

A single specimen in the Museum of the Academy, from the Cretaceous of North Carolina (Ripley group). Named in honor of Prof. W. C. Kerr, State Geologist of North Carolina.

SURCULA, H. and A. Ad.

S. strigosa, n. s.

Shell very long and slender; spire and aperture of nearly equal length; whorls broadly rounded, perhaps eight in number (apices

broken), those of the spire marked by a peculiar revolving constriction just above the suture. Surface cancellated by numerous, small, longitudinal ribs, somewhat smaller than their interspaces, and crossed by still smaller revolving lines. These latter continue over the whole surface to the end of the canal.

Length 3 inches; width 0.6 inch.

From a light-colored Cretaceous marl from Holmdale, N. J., from the collection of the N. J. Geological Survey, kindly loaned to me by Prof. Cook.

This is the most slender species of the genus with which I am acquainted. The shell substance is entirely destroyed, but the surface characters are preserved, all except the lines of growth. I am consequently unable to describe the shape of the outer lip. The groove above the suture causes an appearance, at first sight, as if the top of the whorls was bordered by a thickening; but the separation of the volutions is still marked by a slight fissure in the suture, which is placed about a tenth of an inch below the groove. This seems to have died out on the body whorl.

S. (Surculites) Mathewsonii, Gabb.

Fusus, id., G., Pal. Cal. v. 1, p. 83, pl. 18, f. 33.

S. (Surculites) io., Gabb.

? Fusciolaria, id., G., Pal. Cal. v. 1, p. 101, pl. 28, f. 214.

Both of these species, as seen from better specimens than I had originally, have the broad, shallow sinus on the upper part of the whorl, characteristic of *Surcula*. The first certainly belongs to Mr. Conrad's subgenus; the latter, however, with its tuberculated volutions, may have to be separated, though there is no named division into which to remove it. Generically, or subgenerically, they only differ in this character.

Drillia, Gray.

D. Georgiana, n. s.

Shell elongate, fusiform; spire elevated, longer than the mouth; whorls seven or eight, flattened, bordered by a thickened rim adjoining the suture; below this is a groove followed by a series of heavy longitudinal ribs, about 12 or 13 to a volution. These ribs are not well defined beyond the middle of the body whorl. Crossing the entire surface are numerous revolving lines, appearing as small ribs on the upper whorls, and as narrow impressed grooves on the last whorl. Notch narrow and shallow (as determined

from lines of growth), and corresponding to the groove below the thickened upper margin of the shell. Canal moderately long; details of it and of the mouth unknown.

Length 1.5 inch; width 0.4 inch.

From the Ripley group, Pataula Creek, Clay Co., Georgia; Dr. Little.

A pretty species, resembling *Turris Ripleyana*, Con. (Journ. Acad., 2 s., v. 3, pl. 35, f. 21), in ornament, but more slender, with a higher spire and shorter body whorl.

TRITONIUM, Linck.

Subgenus LAGENA, H. and A. Ad.

T. (L.?) edentatum, n. s.

Shell thin, short, broadly subfusiform; spire moderately elevated; whorls seven; spire turriculated; whorls of spire subangulated and sloping above, terminated in a thickened, beaded margin adjoining the suture, and constricted below this margin; body whorl regularly rounded. Upper whorls marked by numerous longitudinal ribs, sometimes visible on the upper part of the body whorl, sometimes obsolete. These are crossed by revolving lines, always distinct on the spire and on the anterior part of the body whorl, but sometimes obsolete on the middle. Aperture broad, subelliptical; canal short, very slightly recurved. Outer lip simple; inner lip lightly encrusted. No tooth on the posterior part of the inner lip.

Length 1.4 inch; width 1 inch.

A smooth, rounded shell, with ornamented spire, rather plain body volution, and no varices. With the following species, to which it is closely allied, it seems to form a distinct group in the Tritons, nearest, however, to *Lagena*, to which I have referred it, but differing in the absence of the tooth.

Common on Pataula Creek, Georgia; Dr. Little.

T. (L.?) interruptum, Con. (sp.).

Chemnitzia, *id.*, Con., Journ. Acad., 2 ser., v. 3, p. 333, pl. 35, f. 15.

With the preceding. Mr. Conrad describes the species as having the "spire prominent;" but my specimen, as well as his figure, shows that it is not so long as the mouth.

Chemnitzia? gloriosa, Roem. Kried. von Texas, p. 40, pl. 4. f. 3. From the remarkable resemblance in the style of ornament

of this shell to the two preceding, I have little doubt that it is subgenerically identical with them. Roemer's fanciful restoration of the anterior end of the mouth, of course, goes for nothing.

Nassa, Lam.

N. globosa, n. s.

Shell thin, subglobose; spire moderately elevated; whorls six or seven, the upper whorls costate, the ribs not reaching to the suture; above the ends of the ribs is a narrow concave space; suture bordered by a slight thickening of the margin of the succeeding volution; suture not impressed, although well marked—partly obliterated by irregular lines of growth. Body whorl not ribbed, but ornamented by small indistinct and sometimes almost obsolete revolving lines. Aperture oblique; outer lip simple; inner lip rather heavily encrusted by a narrow deposit, and terminating in front in a heavy rib, hardly visible externally; anterior notch narrow and deep.

Dimensions of a small specimen: length 1.0 inch; width 0.9 inch. Other specimens, too imperfect for measurement, indicate a size nearly twice that given.

From the Ripley group of North Carolina, Museum of the Academy, from Prof. Kerr, and from the same deposit on Pataula Creek, Georgia, from Dr. Little.

Fasciolaria, Lam.

F. Slackii, Gabb.

Proc. Acad. 1861, p. 323.

Described from a single internal cast from New Jersey. The longitudinal ribs are large, showing strongly on the cast. The revolving sculpture, if it existed, is unknown. From the shape and from the cast of the columellar fold it most probably belongs to Meek's subgenus *Piestochilus*.

Subgenus Cryptorhytis, Meek.

F. (C.) crassicosta, n. s.

Shell small, broadly fusiform; spire moderately elevated, number of volutions unknown, suture well marked and undulated; body whorl subangulated, flattened above, convex in the middle, and rapidly constricted in advance. Surface bearing about nine large rounded longitudinal ribs, beginning near the suture, strongly developed on the upper angle and disappearing with

the convexity in advance; the entire surface to the end of the canal, is crossed by small but well-defined revolving elevated lines, showing a slight tendency to alternation in size. Aperture broad above, constricted into a moderately short twisted canal; inner lip encrusted terminating in advance in a single heavy oblique fold.

Length about 1.0 inch; width about .65 inch.

A single specimen from Pataula Creek, Georgia; Dr. Little.

It is somewhat distorted in shape by pressure, and has lost part of its apex; but its heavy ribs and strongly twisted columella will distinguish it.

F. (C.) Kerri, n. s.

Shell small, subfusiform, spire shorter than the aperture, whorls five, suture minutely channelled; upper whorls sloping convexly; body whorl regularly convex and gradually contracted in advance into a moderately long and somewhat curved canal; surface marked by a few large square revolving ribs, five on the convex part of the body whorl, and numerous smaller ones in advance; these are crossed by faint longitudinal ribs, more closely placed than the first. At the points of crossing, these two sets of ribs develop well-marked little nodes or tubercles. On the spire, the longitudinal ornaments do not appear, but each volution carries three revolving ribs, the upper of which is smallest Aperture gradually narrowed in front; inner lip somewhat encrusted and bearing a small oblique fold on the angle.

Length .75 inch; width .4 inch.

From the Ripley of N. Carolina; Prof. Kerr.

F. (C.) obliquicostata, n. s.

Shell small, fusiform, spire not quite as long as the aperture; whorls about five or six, upper surface rounded, subtruncated; body whorl widest above, top sloping, tapering in front. Surface marked by a few large oblique ribs with broad concave interspaces; these ribs begin at the suture, are most prominent on the angle of the whorl and disappear in front. The entire surface is also crossed by numerous fine revolving striæ. Aperture gradually narrowing in advance; inner lip sinuous, encrusted; fold small, very oblique; canal moderately twisted.

Length .9 inch; width .45 inch.

Locality; with the preceding.

From *F.* (*C.*) *crassicosta*, this shell differs in its much more slender form, its higher spire, less twisted canal, and in the longitudinal folds being much more compressed laterally and placed obliquely instead of direct.

PYROPSIS, Con.

P. Richardsonii, Tuomey, sp.

Pyrula. id., Tuomey, Proc. Acad. 1855, p. 169.

Perissolax? id., Gabb, Syn. Cret. p. 69.[1]

Tudicla (*Pyropsis*) *perlata*, Con., J. Acad. 2 s., v. 4, p. 288, pl. 46, f. 39.

This species is found in New Jersey, and is abundant in the white limestone of Prairie Bluff, Ala. Dr. Little has sent me one internal cast from Pataula Creek, showing that it grows to a diameter of nearly two inches.

P. Bairdi, M. & H. (sp.) Meek.

Pyrula Bairdi, M. & H.

With the additional information furnished by Mr. Meek's illustrations, especially by the wood-cut, p. 371 of his admirable memoir, I am convinced that there is no generic, or even subgeneric difference between his species, and that of Mr. Conrad's type, lying before me; unless it may be found in the end of the canal of the Eastern species, and which has never yet been found. *P. Richardsonii* has a slender canal, probably not umbilicated, but this is not ground enough for a separation. The characters of the inner lips of the two species are identical.

P. elevata, Gabb.

Rapa, id., Gabb, Journ. Acad. 2 s., v. 4, p. 301, pl. 48, f. 12.

Tudicla, id., Gabb, Syn. Cret. 1861, p. 85, *id.* Meek, Check List Cret. No. 750.

Described from the brown sandy marl of Burlington Co., N. J. But a single internal cast has ever been found and this corresponds so nearly in size and shape with *P. Bairdi*, that I suspect it of being identical. It is certainly not the same as *P. Richardsonii* (*perlata Con.*), as Mr. Conrad intimated in Journ. Conch., 1868, p. 248.

[1] This arose from an error, I having confounded Tuomey's two species, and transposed them in their genera. I intended to put this under *Tudicla*, and to put *trochiformis*, which is a round bodied shell, under *Perissolax*. Even this, however, would have been wrong, since, as will be seen below, on obtaining more material I am obliged to separate it.

? **P. trochiformis**, Tuomey (sp.).

Pyrula, *id.*, Tuomey, Proc. Acad. Nat. Science, 1855, p. 169.

Tudicla, *id.*, Gabb, Syn. Cret., p. 85.

Shell moderately large, spire somewhat elevated; body whorl convex on the sides, sloping above, canal long and straight; surface marked by prominent acute revolving ribs, about nine on the body whorl and others pretty regularly placed, to the end of the canal; between these are concave interspaces, and those on the body whorl are, in some specimens, crossed by faint longitudinal ribs. The inner lip is encrusted, and, just where the mouth contracts into the canal, bears a prominent bend like that in some of the *Fasciolarias*, but without folds; or better, resembling somewhat *Busycon*.

Length 3.75 inches; width 2.0 inches.

A fossil, common as casts in New Jersey, and in the white limestones of Alabama. The above description is from a specimen in the Museum of Yale College, from Uniontown, Ala. It is the only one showing the entire surface, that I have ever seen, and also the only one retaining its entire canal.

I have long had doubts as to the generic relations of this shell, and have referred it provisionally to *Pyropsis*, since that is the nearest clearly defined genus. The columella of my specimen is not perfect enough to warrant me in asserting that the inner lip may not be like that of *Pyropsis*, though I think, as described above, it is more like that of *Busycon*. Should this eventually prove to be the case, the species, with probably both the following, must be separated as a distinct genus, for which the name *Trochifusus* would not be inappropriate.

P. septemlirata, Gabb.

Cancellaria, *id.*, Gabb, Proc. Acad. 1860, p. 94, pl. 2, f. 10.

A shell closely allied to the preceding, and also marked by revolving sculpture, but differing in having a much lower spire, less globose body whorl, tapering into the canal much more regularly in front. The species was described from internal casts, from the New Jersey marls, and in no case has the canal been preserved. Enough, however, has been obtained to show the peculiar curve of the columellar margin.

P. Alabamensis, Gabb.

Cancellaria, *id.*, Gabb, Journ. Acad., 2 s., v. 4, p. 301, pl. 48, f. 14.

Also described from an internal cast, showing slight traces of longitudinal ribs. Another, smaller specimen, from Mississippi,

also a cast, shows that the surface had both longitudinal and revolving ornaments. There were about 12 or 13 longitudinal ribs, crossed by eight or ten smaller, revolving ribs. This also shows part of a long, straight canal. The longitudinal ribs and the high spire separate this from all other species yet known in the genus. I also have it, but in a very imperfect state, from New Jersey (Vincenttown, Col. Bryan).

VOLUTIDÆ, Fleming.

Almost every author who has written on this family has suggested a different grouping of the genera, and no two fully agree in regard to the range of the genera themselves. Among the more modern writers, H. and A. Adams proposed three subfamilies: *Cymbiinæ*, *Zidoninæ*, and *Volutinæ*. Under the first, they place the genera *Cymbium*, *Melo*, with the subgenus *Ausoba*, and *Aulica*. In *Zidoninæ*, the genus *Zidonia* = *Volutella*; and in the last subfamily, genera *Callipara*, *Cymbiola*, *Scaphella*, with subgenus *Alcithœ*, *Voluta*, *Harpula*, *Fulgoraria*, with subgenera *Aurinia*, *Lyria*, with subgenera *Enæta* and *Volutilithes*. In the appendix to their work these authors change the arrangement, as follows:—

Subfamily VOLUTINÆ.

Genera CYMBIUM.
MELO.
SCAPHA.
Subgenera *Aurinia* (*Livonia*, Gray).
Aulica.
Cymbiola.
Alcithœ.
VOLUTA.
Chlorosina.
Harpula.
FULGORARIA.
LYRIA.
Harpella.
Enæta.
VOLUTILITHES.
CALLIPARA.
ZIDONA.
Ausoba (*Nobilia*, Gray).
Ericusa (*Scaphella*, G., not Sw.).

Subfamily SCAPHELLINÆ.

Genus SCAPHELLA (*Amoria*, Gray).

They also adopt Dr. Gray's subfamily *Volutimitrinæ* for the genus *Volutimitra*.

Dr. Gray, in the Guide to Systematic Distribution of Mollusca in the British Museum (1857), proposed a somewhat different arrangement, as follows:—

a. VOLUTINA.

†YETINA.

Genera 1. YETUS.
2. CYMBIUM.
3. SCAPHA.
4. FULGORARIA.
5. CALLIPARA.
6. VOLUTA.
7. LYRIA.
Subgenera *Lyria.*
Enæta.
8. VOLUTELLA.

††AMORIANA.

9. AMORIA.

b. VOLUTIMITRINÆ.

10. VOLUTIMITRA.

And finally the subfamily PORCELLANINA, made up of *Porcellana* (= *Marginella*), *Closia* (= *Volutella*, Sw.), and *Persicula*. This latter group must be thrown out.

In 1873, Dr. Theodore Gill proposed an arrangement of the Families of Mollusca, in which he separates the family into two groups:—

a. Volutimitrinæ = { Volutimitrina, Gray. / Amoriana, Gray.

b. Volutinæ = { Volutina, Gray. / Yetina, Gray.

This division, as I have been personally informed by the author, is based on the dentition; a character not always the most reliable, though in this case it seems to be sustained by the others.

Reversing the position of the groups, as placed by Dr. Gill, it seems to me that the following genera include all of the known species, and are sufficiently clearly circumscribed:—

Subfamily VOLUTINÆ.

CYMBIUM, Klein, Auct.
Yetus, Adams, Gray.

MELO, Humph.
Type *Voluta melo.*

SCAPHA, Gray (not Humph. nor Klein).
Subgenus *Aurinia*, H. and A. Ad.
Type *S. dubia.*

AULICA, Gray.
Ausoba, H. and A. Ad.
Type *V. aulica.*

VOLUTELLA, D'Orb. 1839.
Zidona, H. and A. Ad.
Type *V. angulata.*

H. and A. Adams have renamed this genus because the name *Volutella* was preoccupied both by Perry and Swainson. But since neither of their names stand, D'Orbigny's, being the oldest, must, and *Zidona* becomes a synonym.

CALLIPARA, Gray, 1847.
Type *C. bullata.*

CYMBIOLA, Sw. 1853.
Type *C. ancilla.*

ALCITHŒ, H. and A. Ad. 1853.
Type *V. fulgetrum.*

VOLUTA, Linn.
Harpula, Sw.
Type *V. musica.*

Although *V. vexillum*, Swainson's typical species, looks sufficiently unlike *V. musica* to have warranted a separation, it only requires a study of a large series of specimens, of the few species in this group, to satisfy one that the division has not even a subgeneric value. *V. musica* alone varies through half a dozen spe-

cific names, some of the extreme forms almost as round as *vexillum*. I have fossil specimens from the Pliocene of Costa Rica, almost exactly the shape of *V. vexillum*, without a tubercle on the angle of the whorl, and marked with as many folds on the inner lip as a *Cypræa*.[1]

FULGORARIA, Schum. 1817.
Fulguraria, H. and A. Ad.
Type *F. rupestris*, Gm.

VOLUTODERMA, Gabb. New genus.

Shape similar to *Fulgoraria*, which it also resembles more or less in surface sculpture; apex not papillate; inner lip marked by from three to five well-marked folds, not very oblique, and of pretty uniform size. This is a group of shells characteristic of the cretaceous rocks, and, perhaps, peculiar to them. They are all somewhat slender, and are marked by longitudinal ribs, not always well defined, and by revolving ribs; the columella is always straight or nearly so, and the folds are as isolated and distinct as those of *Turbinella*. But the most strongly distinguishing character is the entire absence of the irregularly rounded mass at the apex of the shell, one of the best characters of *Fulgoraria*. The species have been referred to *Voluta*, *Volutilithes*, *Fulgoraria*, and even *Fasciolaria*. *V. Navarroensis*, Shum., Gabb, Palæontology of California, vol. i., pl. 19, f. 6, may be taken as the type. The genus includes such species as—

V. elongata, d'Orb. sp.
Voluta, id., d'Orb., Pal. Fr. Cret., v. 2, p. 323, pl. 220, f. 3.
Volutilithes, id., Stol., Sitz. Akad. Wien., lii. p. 74.
Fulguraria, id., Stol., Pal. Ind., p. 87, pl. 7, f. 1–9.
Voluta Trichinopolitensis, Fbs., Tr. Geol. Soc. Lond. v. 7, p. 133, pl. 15, f. 5.

This shell is very variable in height, and carries three equal columellar folds. Specimens before me, sent to me by Dr. Stoliczka, from Trichinopoly, show that the apex is as acute as in my Californian shell.

Another shell, accompanying this, marked *Fasciolaria rigida*, Stol., bi. cit., p. 109, pl. 10, f. 10–16 (*Voluta rigida*, Baily), evi-

[1] For further remarks on this subject see Crosse, Journal de Conchyliologie, vol. 19, p. 271.

dently also belongs to this genus, as well as do *Fasc. carinata*, Stol., and *F. assimilis*, Stol.

AURINIA, H. and A. Ad. 1853.
Type *A. dubia.*

VOLUTOMORPHA, Gabb. New genus.

Shell elongate, fusiform; whorls cancellated by longitudinal and revolving ribs. Columella with one very oblique fold, and sometimes one or more smaller secondary folds. In shape this genus is not unlike the two preceding genera, but it differs from them all in having essentially a single large oblique fold. When more than one occurs, the secondary folds are smaller than the large primary.

Type *Volutilithes Conradi*, Gabb, Journal Acad. Nat. Sciences, 2 s., v. 4, pl. 48, f. 10.

V. CRETACEA, Con., *loc. cit.*, pl. 47, f. 18, also belongs to this genus, and *V. Delawarensis*, Gabb, Proc. Acad. 1861, p. 322.

ROSTELLITES, Con. 1855.
Type *R. Texana*, Con., Emory's Report, Mexican Boundary Survey, p. 158, pl. 14, f. 2.

A curious genus, the most slender of the Volutes, with numerous equal plaits on the columella, and with the outer lip somewhat expanded anteriorly.

VOLUTIFUSUS, Con. 1866.
Type *V. typus*, Con., J. Conch., 1866, p. 67, pl. 3, f. 2.

Very characteristic of the Miocene.

LYRIA, Gray, 1847.
Type *L. Delessertii.*

ENÆTA, H. and A. Adams, 1853.
Types *L. Cummingii, harpa*, etc.

Marked by a tooth in the middle of the outer lip, seems to be but a division of *Lyria.*

VOLUTILITHES, Swains, 1831.
Type *V. abyssicola.*

A genus abundant in the Eocene rocks, perhaps found in the Cretaceous, and represented in the living fauna by but a single species.

ATHLETA, Con., 1853.

Types *A. rarispina* and *A. Tuomeyi*, Con., J. Acad., 2 s. v. 4, pl. 47, f. 35.

A form separated by Conrad from *Volutilithes* on account of a heavy callosity deposited on the spire above the aperture.

LEIODERMA, Conrad, 1865, Proc. Acad., 1865, p. 184.

Type *L. leioderma*, Con., J. Acad., 2 s. v. 4, p. 292, pl. 46, f. 32.

Includes also *Volutilithes cretacea*, Con., *loc. cit.*, v. 3, p. 333, pl. 35, f. 16.

Subfamily SCAPHELLINÆ, H. and A. Ad.

Volutimitrinæ, Gill; *Volutimitrina and Amoriana*, Gray.

SCAPHELLA, Swains., 1832.

Amoria, Gray.

Type *S. Junonia*.

VOLUTIFUSUS, Con., 1866.

Type *V. typus*, Con., J. Conch., 1866, p. 67, pl. 3, f. 2.

Very characteristic of the Miocene, but does not include *V. Junonia*, as Mr. Conrad intimates.

VOLUTIMITRA, Gray.

Types *V. Grœnlandica*.

In addition to the above, there are perhaps several other genera among the fossil Volutes. *V. rarispina*, Lam., with which I am only acquainted by published figures, may be an *Athleta*, or it may be new. It certainly cannot be placed in any other genus.

The two shells, *Athleta purpuriformis* and *A. scrobiculata*, of Stoliczka, were referred to that genus from a misconception on the part of the author. They have not the characteristic callous, are subglobular, instead of being subfusiform and angulated, and the folds are very oblique, and on the anterior part of the columella. The genus might be called PTYCHORIS.

Ficulopsis Stoliczka, Pal. Indica, p. 84, founded on *Pyrula Pondicherriensis*, Forbes, is a *Ficus*, with folds on the columella. I have just received from the Cretaceous of Georgia an allied form, with a flattened columella and with a single fold. I cannot agree with the author in placing it in the *Volutidæ*.

Megaptygma, Con., founded on a Miocene species, described by me under the name of *Voluta sinuosa*, differs only from *Volutifusus* in having the folds unusually heavy. Together with Mr. Conrad, I have compared it with several species of the latter genus, and find that some of the species, especially *V. mutabilis*, Con., vary so in this character, that we have agreed that the distinction is not a valid one. *V. mutabilis* varies not only in the presence and absence of folds, but also in their direction when present, and in the shape of the anterior half of the shell. Some specimens are perfectly straight in advance, while others are as twisted as the typical form of *V. Junonia*. In fact I am by no means convinced that *Volutifusus* should be separated from *Scaphella*.

LEIODERMA, Con.

L. canalis, Con. sp.

Conus, id., Con., J. Acad., 2 s. v. 3, p. 331, pl. 35, f. 22.
Volutilithes cretacea, Con., J. Acad., 2 s. v. 3, p. 333, pl. 35, f. 16.

Common at Pataula Creek, Clay Co., Ga. A long, slender, fusiform shell, with a polished surface, high spire, with the upper whorls faintly ribbed longitudinally. The outer lip is slightly thickened at its junction with the body whorls, and obliquely truncated in advance. The columella bears a single faint very oblique fold. Its surface, although polished, shows strong lines of growth. Mr. Conrad agrees with me in the above synonymy.

I have a cast, apparently of the same species, from Crosswicks, New Jersey.

VOLUTODERMA, Gabb.

? V. biplicata, Gabb.

Volutilithes biplicata, Gabb, Journ. Acad., 2 s. v. 4, p. 300, pl. 48, f. 6.
Rostellites biplicatus, Meek, Cret. Check List, No. 690.

But a single specimen of this species has ever been found. It shows none of the surface, but its form is so peculiar that it cannot be mistaken. Its two folds are in such a position that I have little hesitation in referring it to this genus.

V. sp. indet.

Another form occurs in the brown marls of Vincenttown, N. J., of which two internal casts have been found by Col. T. M. Bryan. In size and general shape it approaches *Volutomorpha Conradi*, but has three strong transverse folds on the middle of the columella. From impressions on the inner face of the cast of the outer

whorl its surface is covered by small longitudinal ribs, crossed by numerous revolving lines, the characteristic sculpture of the genus.

VOLUTOMORPHA, Gabb.

V. Conradi, Gabb.

Volutilithes, id., Gabb, Journ. Acad., 2 s. v. 4, p. 300, pl. 48, f. 10.
Rostellites, id., Meek, Cretaceous Check List, No. 691.

The typical species of the genus. A common fossil in New Jersey. I have not seen it yet from other parts of our Cretaceous deposits. It is a long, slender, fusiform shell, a little variable in shape, but always slightly subangulated on the upper part of the whorl; the middle is gently convex, with the sides converging in advance. The canal is straight, and the columella bears one large oblique fold. Sometimes one or two smaller secondary folds occur. The surface is marked by numerous longitudinal ribs crossed by more closely placed revolving ribs. Impressions of this surface in the matrix, and on the inner face of the cast of the body whorl are not rare, but I had never seen even a piece of shell preserved until a few days ago, when Col. Bryan brought me a body volution with a third of its surface covered with well-preserved shell.

V. Abbotti, Gabb.

Volutilithes id., G., Proc. Acad. Nat. Sci. 1860, p. 94, pl. 2, f. 7.

The surface of this shell is as yet unknown. The columella, besides the large typical fold, carries also three smaller and more transverse ones above.

V. Saffordi, Gabb.

Volutilithes id., Gabb, Journ. Acad., 2 s., v. 4, p. 300, pl. 48, f. 8.

A strongly cancellated species, approaching the preceding in form.

V. bella, Gabb.

Volutilithes id., Gabb, Journ. Acad., 2 s., v. 4, p. 300, pl. 48, f. 7.
Rostellites id., Meek, Check List Cret. No. 689.

A remarkably symmetrical fusiform shell, not very rare in New Jersey. Its surface is unknown.

V. Kanei, Gabb,

Voluta id., Gabb, Proc. Acad. 1861, p. 322.

V. mucronata, Gabb.

Voluta id., G., loc. cit. p. 322.

ROSTELLITES, Con.

R. nasutus, Gabb, sp., Meek, Check List, No. 692.

Volutilithes id., G., Journ. Acad., 2 s., v. 4, p. 300, pl. 48, f. 9.

This shell has normally three folds on the columella, but I have seen specimens with five or six. It is the most slender of all the *Volutidæ* of New Jersey, and can be distinguished, even in casts, by the entire absence of longitudinal ribs or plications. Prof. Geo. Cook, State Geologist of New Jersey, who has loaned me all the desirable specimens of the survey collection, has at last obtained this shell, showing the surface. Unlike most of the marl fossils, these specimens, of which there are several, are fossilized, so that, while all shell structure is destroyed, being replaced by marl, the surface characters are perfectly preserved. The species is characterized by about 17 or 18 elevated, thin, revolving ribs, those in advance placed very obliquely; the interspaces are three or four times as wide as the ribs. All the specimens are more or less distorted, but enough remains to show that the outer lip was broadly expanded, and, perhaps, even very slightly everted in advance.

From Pataula Creek, Clay Co., Georgia, Dr. Little has sent me some imperfect internal casts which seem to belong to this species, but which are unusually large. Better material may prove them to belong to a distinct species.

PTYCHOSYCA, N. gen.

Shell like *Ficus* in shape; surface smooth (or sculptured?); inner lip bearing one very oblique fold on the anterior part of the columella.

This shell fills in a gap in the series of genera, and connects Stoliczka's genus *Ficulopsis* with the true *Ficus*. *Ficulopsis* has the same general style of sculpture as *Ficus*, but bears several plaits on the columella, so like some of the Volutes that Dr. Stoliczka united it with them in the same family. The present genus has a fold, but it is small and very oblique. The posterior notch, which the author mentions as doubtfully a generic character in his species, seems, from a study of ours, to be so. In *Ficus*, the outer lip shows a very slight trace of it; in our genus it is more marked, while in the Indian fossil it develops into a regular Pleurotomoid sinus.

P. incrnata, n. s., pl. 17, f. 2, 3, 4.

Shell small, regularly convex; spire small; number of whorls unknown (apex destroyed on the only specimen); suture nearly obsolete; surface without other marks than faint lines of growth; body whorl convex above, tapering in advance, slightly constricted by a broad, shallow, revolving groove in advance; canal short, notched in advance; outer lip very slightly notched posteriorly, immediately adjoining the suture; inner lip thinly encrusted and bearing one very oblique fold.

Length about 1.5; width about .75. The specimen is compressed, so that, with the loss of the tip of the canal, the measurements can be only approximate. The lines of growth, which are distinct, enabled me to ascertain the details of the anterior end.

A single specimen from the Ripley group, Pataula Creek, Georgia; Dr. Little.

GYRODES, Con.

G. abyssinia, Morton (sp.).

Natica id., Morton, Syn. Cret. p. 49, pl. 13, f. 13.
Gyrodes id., Gabb, Syn. Moll. Cret. p. 59.

Described originally from Prairie Bluff, Ala. We did not know the surface of this shell, until now I have received from Dr. Little specimens from the Ripley group, from Pataula Creek, Georgia. The surface is perfectly plain, slightly flattened adjoining the suture, and with the umbilical margin rounded. It is marked only by lines of growth, and has none of the crenation of the upper edge, characteristic of Conrad's species *G. crenata*. It also occurs, though rare, in New Jersey.

G. petrosa, Morton, (sp.).

Natica id., Morton, Syn Cret. p. 48, pl. 19, f. 6.
Gyrodes id., Conrad, Journ. Acad., 2 s., v. 4, p. 289.
G. alveata, Con., loc. cit. p. 289, pl. 46, f. 45.

Originally described from internal casts from Prairie Bluff, Ala. Mr. Conrad's species, from the Ripley group of Mississippi, was described from shells retaining their surface. They are identical, and we have the same species from Glassboro, N. J., from Colonel Bryan, and from Mullica Hill, whence it was brought by Mr. John Ford.

AMAUROPSIS, Mörch.

A. paludinæformis, H. and M. (sp.).

Natica id., H. and M., Mem. Am. Acad., Boston, v. 5, p. 389, pl. 3, f. 3.

A. id., M. and H., Proc. Phil. Acad. 1860, 185.

In the Academy's museum are half a dozen specimens of this species, brought by Mr. Conrad from Haddonfield, N. J.

LUNATIA, Lam.

L. rectilabrum, Con.

There is yet some confusion about this species. Mr. Conrad described it as a *Natica* in the Journal Phil. Acad. 2 ser. vol. 4, p. 344, pl. 35, f. 28. In my synopsis of Cretaceous Mollusca, I placed it as a synonym of Hall and Meek's *concinna*. In Hayden's report, Mr. Meek refers it to H. and M.'s *obliquata*, and separates *concinna* and *obliquata* on the ground that the latter has an opercular groove, wanting in the former. This hardly seems to me to be a valid specific difference, and I believe the synonymy should stand as follows:—

L. obliquata, H. and M. (sp.), Meek, Cret. Check List, No. 672.

Natica, id., H. and M., Mem. Bost. Acad., v. 5, p. 389, pl. 3, f. 1.

N. concinna, H. and M., *loc. cit.*, p. 389, pl. 3, f. 2.

N. moreauensis, M. and H., Proc. Acad., 1856, pp. 64, 282.

Lunatia concinna, Meek, Hayden's Rep., p. 314.

N. rectilabrum, Con., J. Acad., 2 s. v. 4, p. 344, pl. 35, f. 28.

N. acutispira, Shum., Trans. St. Louis Acad., 1860, p. 597.

It is common everywhere in the Ripley Group, and Dr. Little now sends it from Pataula Creek. The altitude of the spire, and the obliquity of the body whorl differ considerably in the eastern shell, as is frequently the case with *Naticas*, and, consequently, if there is no difference except the presence or absence of a groove, and a slight one at that, made by the operculum on the pillar lip, the difference is too slight to divide them. *N. acutispira* of Shumard, of which I compared a specimen, some years ago, with the Atlantic form, also comes into this synonymy.

SCALA (Klein), Humph. 1797.

Scalaria, Lam., 1801.

S. (Opalia) Thomasi, n. s.

subulate, whorls numerous, increasing gra-
rving abruptly to the suture; surface

marked by numerous, small, very thin plates, and crossed by well marked though small revolving lines, base bordered by an angular carina. From the white limestone of New Jersey, a single specimen given me by Prof. W. H. B. Thomas. Its nearest ally, *S.* (*O.*) *Sillimani*, Morton, from Prairie Bluff, Ala., is a somewhat larger shell, with a wider apical angle, the varices, instead of being numerous thin plates, are fewer and thickened, and the revolving sculpture is much finer. From *S. annulata*, Morton, found with it in New Jersey, it can be at once distinguished by its much narrower apical angle, very much smaller size, and in the ornaments. In that species, in the adult stage, the ribs become rounded on their edges; in the young shells they are squamose, though not so numerous, and the revolving sculpture is fine and closely placed. From the following species it can be known by the plates being smaller and thinner, by the revolving sculpture, which in this is marked, while in that it is either very fine or wanting. Further, in this species, the carina at the base of the whorls is merely a strongly marked angle, over which the longitudinal markings cross without change; the plates very regularly decreasing in prominence from the sides to the base of the whorls, and reaching the lip as mere threads. In that species the carina is a strong rib, and the longitudinal plates continue well elevated and thick to the end. I have not described the mouth, because in the only specimen it is in great part broken away. From a trace in the umbilical region, it seems to have been bordered by the usual thickened lip.

S. (O.) cyclostoma, n. s.

Shell smaller and slightly more slender than the preceding; whorls seven, cross sections circular; surface marked by numerous prominent recurved ribs, one of which on each whorl is thickened, showing a periodical arrest in growth; between these ribs is very minute revolving sculpture, a little more distinct on the earlier whorls. Aperture circular, bordered by a very thick expanded lip; base of body whorl bordered by a strong rib.

Length .55 inch, width .25 inch.

In the large varices this is not unlike *S. Sillimani*, but it is distinguished by its smaller size, narrower whorls, less thickened longitudinal ribs, and by the base. In that species the base is much flatter, the revolving carina is less evident, and each rib, on

the angle is reflexed back into a little lip or notch; these ribs also become much less distinct on the base.

S. (O.) annulata, Morton.

Scalaria, id., Morton, Synopsis, p. 47, pl. 3, f. 10.

A character exists in this shell which has never been mentioned. It has a broad open umbilicus, bordered by an angle, as well marked as that of *Architectonica*, though, of course, not so large.

I have yet another species from Georgetown, Georgia, from Dr. Little, nearest to *S. annulata* in the character of its ribs, but apparently more like *S. Sillimani*, in the shape of the shell. It consists of only one whorl and a part of another imbedded in a hard rock and too imperfect for description.

PUGNELLUS, Con.

Dr. Little has sent me from the Ripley marl of Pataula Creek, Clay Co., Georgia, specimens of Conrad's original *Strombus densatus*, Journ. Acad., 2 ser. vol. 3, p. 330, pl. 34, f. 6, which have enabled me to discover that it is a very different shell from that which the same author called *Pugnellus densatus*, in the 4th volume of the same work, p. 284, pl. 46, fig. 31. It is more than twice as large as adults of the latter species, the canal is straight, and the outer lip is not so thickened. The first species, that from the 3d volume, must retain the specific name, and that in the 4th volume must be renamed. I, therefore, name it *P. typicus*, since that species was the one for which the genus was first founded. More perfect material than I yet possess may even prove that *P. densatus* may belong to my subgenus *Gymnarus*.

ANCHURA, Con.

A. arenarum, Morton, sp.

Rostellaria, id., Morton, Syn. Cret., p. 48, pl. 5, f. 8.
R. arcuarium, d'Orb., Prod. Pal., v. 2, p. 227.
Chemnitzia distans, Con., Journ. Acad., 2 s. v. 3, p. 333, pl. 35, f. 30.

With the preceding, from Dr. Little.

A. Texana, Roem., sp.

Scalaria, id., Roem., Kreid von Texas, p. 39, pl. 4, f. 11 *a–b*.
Chemnitzia, id., Meek, Check List, No. 658.
" " Gabb, Pal. Cal., vol. 2, p. 261.
Aporrhais, id., Stoliczka, Pal. India, vol. 2, p. 281.

Stoliczka says he examined, in the museum in Bonn, the original of *Scalaria Texana*, "and found that it was based upon an imper-

fect specimen of an *Aporrhais*." On re-examining my own specimen of the species I see nothing incompatible with its belonging to the genus *Anchura*, a view which is sustained by Roemer's figure, and doubtless Dr. Stoliczka found some remains of the expanded lip, or of the terminal ascending suture line. He did not understand the genus *Anchura*, restricting it to those species in which the outer lip bears two points, one posterior, the other running parallel with the canal. As I have shown elsewhere the genus cannot be so restricted, and there are not even valid grounds for retaining Meek's *Drepanochilus* as a subgeneric division. Stoliczka called two species of *Anchura* by the name of *Aporrhais*, and, therefore, I am satisfied that he meant this same group. The long, slender spire of the species in question is very like many species of *Anchura*, but is wholly incompatible with *Aporrhais*.

APORRHAIS, Dillw.

†A. bicarinata, n. s.

Shell small, spire elevated, number of volutions unknown; upper whorls bearing an angle in the middle, from which the surface slopes inward to the suture; below this angle it slopes very slightly outwards to the sutures below; body whorl bearing two angles on the middle, the upper slightly the largest; outer lip unknown, inner lip lightly encrusted, expanded, and slightly reflected, producing a groove which runs from the posterior angle of the aperture, parallel with the mouth, down to the canal.

Width of body whorl, less the expanded lip, about 0.5 inch. This species is described from two fragments from Pataula Creek, Georgia, sent me by Dr. Little. They are so mutilated that I do not know the outer lip, the canal, nor the upper whorls of the spire. In fact, nothing remains except the body volution and the one adjoining it. Both show the very remarkable character of the inner lip, so that I am convinced it is not an accidental result of crushing. The form of the body whorl is very similar to the little shell described by Mr. Meek, from the Yellowstone region, under the name of *Aporrhais biangulata*. It has the same two carinæ, and, like that shell, is smooth, unlike it, not showing, under a magnifying glass, any trace of sculpture. The most marked difference exists in size, our species being larger than Meek's magnified figure (Hayden's Report, pl. 19, fig. 6 *b*). Another difference occurs in the spire. In that all of the upper whorls are rounded,

in this the upper carina of the body whorl is continued on the middle of the upper whorls, the suture following the lower carina. The peculiar character of the inner lip is not mentioned in Mr. Meek's description, as it certainly would had it been present. As to the generic relations of the present species, it may belong to *Aporrhais*, and I have so referred it on account of its close specific relation to the Northwestern species, or it may prove to be an *Anchura*. In this group the generic determination cannot be certain until we have all of the parts of the perfect adult shell, the classification resting almost entirely on the manner in which the adult forms its mouth.

Turbinopsis, Con.

This genus seems to be not remote from *Trichotropis*, resembling the subgenus *Iphinæ* in form, but differing in having a thick shell, and in bearing a rather obscure fold on the inner lip close to the anterior end. This fold is not visible externally, but can be seen if the outer lip is broken away or on casts.

T. Hilgardi, Con., Journ. Acad., 2d ser., vol. 4, p. 259, pl. 46, fig. 29.
Cancellaria, *id.*, Gabb, Syn. Cret. Moll., p. 42.
T. depressus, Gabb, Proc. Acad., 1861, p. 321.

Found in New Jersey, Delaware, Alabama, and Mississippi. My name given to casts from New Jersey must stand as a synonym.

Gyrotropis. New genus.

Shell thin, resembling *Trichotropis* in form, spire elevated; umbilicus open like in *Iphinæ* and *Turbinopsis;* surface biangulated like in the typical form of *Trichotropis*, but covered also with numerous very thin foliated varices like *Murex*.

A peculiar genus, combining a series of characters which ally it closely to *Trichotropis*, but markedly different in the presence of thin plates covering the surface, and expanded to an unusual degree.

G. squamosus, n. s., pl. 17, fig. 5.

Shell moderate in size, turbinate; spire about as high as the [illegible]oth of the mouth, whorls eight, apex acute, body whorl bicari[illegible]na high and very thin; outline sinuous in front to [illegible]n, concave between the carinæ and above the [illegible]s; upper carina carried on the middle of

all the upper whorls to the apex; suture channelled, the channel formed by the upper surface of the lower carina, the succeeding whorl being soldered to the outer edge of the plate-like ridge; umbilicus open, narrow, deep, bordered by the sharp, acute angle of the base of the volution; surface ornamented by numerous very thin, squamose, murex-like varices, most marked on the anterior part of the shell, these are all crossed by closely placed revolving lines, somewhat alternated in size. Aperture broad, outer lip thin, inner lip rather heavily encrusted.

Length, 1.1 inch; width, 0.9 inch.

From Snow Hill, North Carolina, from the Ripley marl. Collection of the Academy.

Turritella, Lam.

T. encrinoides, Morton, Synopsis, p. 47, pl. 3, fig. 7.

Pataula Creek, Georgia, Dr. Little.

Laxispira. New genus.

Shell spiral, dextral, whorls with a circular cross section, few in number, and so rapidly descending as to form an open spiral; aperture simple, lips thin.

A curious genus, the relations of which are not clear to me. I propose it to receive some shells which have been long known as internal casts in the marls of New Jersey, but of which the surface was unknown until quite recently. In general form they might be compared to a partially uncoiled *Turritella*. From that genus they differ, however, in the whorls not being in contact, and from *Vermetus* and the allied genera in being regular spirals, but not having the apex either turritelloid or attached. Another analogy, though perhaps only one of external resemblance, might be adduced in such shells as *Euomphalus circinalis*, Goldf., or in some of the Delphinulas.

L. lumbricalis, n. s., pl. 17, f. 6, 7.

Shell with a circular cross section, whorls about as far apart as the diameter of the whorls, three or four in number; surface marked by numerous small, closely placed revolving ribs.

This description is from a small specimen from the Ripley marl from Haddonfield, N. J., presented to the Academy by Mr. Conrad. Casts over two inches long and about half an inch in diam-

eter of aperture are common in the glauconite marl, and apparently belong to the same species.

Bivonia, Gray.

†B. cretacea, n s.

Shell tubular, irregularly coiled in the young stage; curved, straight, or irregular as it grows older; surface irregularly wrinkled by lines of growth; aperture circular, substance thick.

Average diameter of shell .25 inch to .3 inch.

I propose this name for a shell consisting of a contorted tube common in the Ripley marls, and which shows so few characters that it is hard to describe it. I have never seen any signs of attachment, and no two specimens are of the same shape. Dr. Little has sent me a good series from Pataula Creek, Georgia.

Endoptygma. New genus.

E. umbilicata, Toumey (sp.), pl. 17, f. 8, 9.

Phorus umbilicatus, Toumey, Proc. Acad., 1855, p. 169.

This shell was described by Tuomey from internal casts well known in the Cretaceous of Mississippi and Alabama. It differs from the typical *Phorus*, Montf. (*Xenophora*, Fisch.) in having a strong revolving plate inside, nearly midway between the umbilical and outer margin on the base, leaving a groove on the cast. The irregularly pitted upper surface shows that the shell agglutinated foreign bodies to its surface in the same manner as in the genus from which I propose to separate it. Figure 8 shows the position of the internal plate, as represented by a groove on the cast; figure 9, a side view of a smaller specimen.

Ataphrus, Gabb.

Palæontology of California, vol. 2, p. 171.

Additional material has enabled me to become better acquainted with this genus, and obliges me to modify a little the generic description. The inner lip is rounded above, on the body whorl, and merges insensibly into the adjoining surface, covering up the umbilicus; but, instead of being round all of the way down, as described, it ends abruptly just at, or a very little in advance of, the umbilicus, in a little tubercle, on the outer or front face of the pillar, below which the lip is slightly grooved. The position I

assigned it, associated with *Oxystele* and *Photinula*, is correct, it differing from the former in having the tubercle and the anterior groove, instead of being flattened; and in wanting the angular termination of the latter.

The figure of *A. crassus* is incorrect, in that it makes the pillar lip round all of the way down.

A. compactus, Gabb.

Littorina, id., G., Pal. Cal., v. 1, p. 131, pl. 20, f. 89.

This is a member of the genus, but the figure and description are incorrect in the one character of the inner lip. Better specimens than the original (which, like that of *A. crassus*, were slightly weathered) show that the groove should only have been represented as extending half way up the inner lip, the upper half being regularly rounded and terminating in the tubercle mentioned. The anterior end of the mouth also is rounder than the figure.

In addition to the above, I have another species from the cretaceous of North Carolina. This shell, from the character of its fossilization gives us another character, the pearly structure; an additional proof of its family affinities, and one which was not attainable in its Californian congeners.

A. Kerri, n. s. Pl. 17, f. 10.

Shell small, turbinate; spire slightly elevated, whorls five, convex above and below, and obscurely angulated in the middle; suture well marked, following the angle in all the upper whorls, but in the adult shell, for the last fourth of a volution, descending at a slightly increased angle. Entire surface covered by small closely placed revolving ribs with acute interspaces. Aperture circular, outer lip retreating very obliquely from the suture and then regularly curving downwards on the middle of the upper half of the whorl; edge acute. Inner lip covering all of the minute umbilicus and then truncated abruptly, a little in advance, as described above.

Height 0.15 inch; diameter 0.21 inch.

A beautiful little shell, closely allied to *A. compactus*, but differing in being less elevated, in the subangulated whorls, in the more rapidly descending suture, near the mouth, and in the sculpture. In *compactus* the sculpture is a series of rather strong, though small revolving ribs. In *A. Kerri* the ribs are so close together, and the interspaces so small that in one case they be-

came nearly obsolete. In another, however, they are stronger, approaching the Californian shell. *A. crassus* differs from this species in the entire absence of revolving sculpture and of angulation, and in its more sloping top.

TURNUS, Gabb.

Subgenus *Xylophagella*, Meek.

T. (X.) contortus, Gabb.

Teredo contorta, G., Proc. Acad., 1861, p. 323.

A study of the valve of this species shows it to be an allied species to *T.* (*X.*) *elegantula*, but more oblique, and differing in sculpture.

MARTESIA, Leach.

M. cretacea, Gabb.

Pholas, *id.*, Gabb, J. Acad., 2 s. v. 4, p. 393, pl. 68, f. 18 (tube). *Id.*, G. Proc. Acad., 1861, p. 324 (shell).

Rare in the marls of New Jersey. The tubes are occasionally found perforating wood, but replaced by pyrites. I have before me an excellently preserved shell with both valves in contact, and which shows clearly the generic characters.

M. cithara, Mort. sp.

Pholas, *id.*, Morton. Syn. Cret., p. 68, pl. 9, f. 2.

P. pectorosa, Con., J. Acad., 2 s. v. 2, p. 293, pl. 24, f. 9.

Equally rare with the preceding. I have never seen but the two respective types.

LEPTOSOLEN, Con.

L. biplicata, Con., J. Conch., v. 3, p. 15.

Siliquaria, *id.*, Con., J. Acad., 2 s. v. 3, p. 324, pl. 34, f. 17.

Not rare on Pataula Creek, Clay Co., Georgia, Dr. Little.

LEGUMEN, Con.

L. planulatus, Con. (sp.).

Solemya, *id.*, Con., J. Acad., 2 s. v. 2, p. 274, pl. 24, f. 11.

Legumen, *id.*, Gabb, Syn. Cret., 1861, p. 133.

L. elliptica, Con., Journ. Acad., 2 s. v. 3, p. 325, pl. 34, f. 19.

L. appressa, Con., *loc. cit.*, p. 325.

A fine shell growing three inches long; several specimens from Pataula Creek, Georgia. It is one of the most widely diffused species in the Ripley marl. On comparing the various types of the above names, I find that the names have been given to dif-

ferent ages of the same shell. The lines of growth at the same age in all the forms have the same direction.

PERIPLOMYA, Con.

Leptomya, Con., Nat. Ad.

Plicomya, Stol.

P. elliptica, Gabb.

Anatina, id., Gabb, Proc. Acad., 1861, p. 324.

I place this shell under the above generic name, in accordance with the opinion of Mr. Conrad, who has examined seven original specimens, and recognized its generic relations. It is an extremely rare shell.

SOLYMA, Con.

Not *Solemya* (as in index).

S. lineolatus, Con., Journ. Conch., vol. 6, p. 75, pl. 3, f. 9.

Mr. Conrad has identified for me, under the above name, a little shell out of the Georgia collection of Dr. Little, from Pataula Creek. It is a little more than half as wide as long, the beak is median, the two ends are very nearly equal, and the base is very slightly convex. Although mine is a left valve, I am unable to describe this part of the hinge, since, in cleaning away the marl, the teeth were destroyed. These fossils are so fragile that, until after being hardened by gum, a breath will almost destroy them. Mr. Conrad, who cleaned this hinge, saw the teeth just at the moment of their destruction.

PHOLADOMYA, Sby.

P. Littlei, n. s.

Shell very large, gibbous, beaks large, prominent, nearly in contact, placed about a third of the length from the anterior end. Base irregularly convex, most prominent a little behind the middle, from which it slopes up with a broad gentle curve to the anterior end; posterior end broader than the anterior and gaping. Surface marked by about a dozen large acute ribs, with broad concave interspaces. The anterior end is not costate, or very faintly so; the first well-marked rib descends directly from the front part of the umbone directly to the base, curving slightly forward at its lower end. The strongest ribs are on the middle of the shell, and they are somewhat more widely placed, and become more oblique posteriorly.

Length 6 inches, width from beak to base 4 inches, diameter of both valves 3 inches.

This is the finest species of the genus with which I am acquainted, and I dedicate it with pleasure to Dr. Little, State Geologist of Georgia, who sent me three well-preserved specimens, one retaining the greater part of its surface, from Pataula Creek, Clay County. It can be at once recognized by its few large ribs, increasing rather than diminishing in size posteriorly, and in being less oblique than *P. occidentalis*, Morton, the only other large species known in America. It is twice the linear size of that shell.

CYMBOPHORA, Gabb.

C. lintea, Con. sp.

Cardium (*Protocardia*) *linteum*, Con., J. Acad., 2 s., v. 4, p. 278, pl. 46, f. 17.

Veleda, id., Con., Journ. Conch. 1871, p. 74.

Veleda, id., Con., Kerr's Geol. Rep. N. Car., p. 9, pl. 1, fig. 26.

Dr. Little sent me a good suite of this species, and on uncovering the hinge, I cannot find any valid difference between it and my typical form, on which to base a generic separation, unless it be on a peculiar cross striation of the lateral teeth, which I did not observe in the Californian shells. The species attains a large size. One specimen measures: length 4 inches, width 3 inches, depth of single valve 1 inch. In its young state it is thin, but becomes quite thick as it grows older. I have ventured to associate these large specimens with Mr. Conrad's species, although in all of them the hinges are destroyed; but I can find no good grounds either in form or surface markings for separating them. My smaller specimens on which I identified the species are an inch and a half long.

SCHIZODESMA, Gray.

? S. appressa, n. s.

Shell small, subtriangular, flattened, thin; beaks sub-central, a little in advance of the middle; anterior end rounded; posterior end produced, subtruncated, cardinal margins sloping rather rapidly from the beaks; base broadly convex; a distinct umbonal ridge runs from the beaks to the posterior basal angle; and one less marked runs nearly parallel with the posterior cardinal margin to the upper angle of the truncated posterior end. Surface marked only by lines of growth. The hinge agrees better with

the above genus than with any other described; in the left valve the V-shaped tooth is delicate, though well marked, and encroaches slightly on the deep ligament pit; the lateral teeth are very small, short, and thin. The species can be at once distinguished from the preceding by its shape.

Length 1.2 inch; width 0.9 inch.

A rare species, from Pataula Creek, Georgia; Dr. Little.

TENEA, Con.

T. pinguis, Con. (sp.)

Lucina, *id.*, Con., Journ. Acad., 2 ser., vol. 2, p. 275, pl. 24, fig. 18.

Diplodonta parilis, Con., *loc. cit.*, vol. 4, p. 278, pl. 46, f. 16 (not 8 as in text).

Mysia gibbosa, Gabb, *loc. cit.*, vol. 4, p. 302, pl. 48, f. 17 (not f. 18 as in text).

Tenea parilis, Con., Journ. Conch., v. 6, p. 73, pl. 3, f. 12, *id.*, Con., Kerr's Geol. Rep. N. Car., p. 8, pl. 2, f. 25.

Mr. Conrad and I redescribed this species simultaneously in the 4th volume of the Academy's Journal, both of us overlooking the fact that it had been previously described as a *Lucina* and with a bad illustration. It does not possess the angular base given to it in vol. 2.

TELLINA, Linn.

Tellinella, Gray.

T. (T.) Georgiana, n. s.

Shell moderately large, elongate; beaks central, elevated, anterior end produced, rounded; base very slightly convex; posterior end subangulated below, arched above; a strong umbonal ridge runs from the beaks to the angle. Surface destroyed on the only specimen I have seen.

Length 2.6 inches; width 1.25 inch.

The impression of the hinge is preserved in the matrix, and the shell is so strongly characterized by its form that I have not hesitated to describe it. It is from Pataula Creek, Georgia, in a hard calcareous marl.

GARI, Schum.

G. elliptica, n. s.

Shell moderately large, very thin, subelliptical in outline; beaks central, somewhat elevated; anterior end prominent above the middle, retreating below with a gentle curve to the base;

posterior end rounded, broader than the anterior; base most prominent a little in advance of the beaks. Surface marked by irregular lines of growth. Ligamental grove strongly marked; hinge consisting of two teeth in the right valve and one bifid tooth in the left.

Length 2.4 inches; width 1.5 inch.

This shell resembles in size and general shape *G. texta*, Gabb, of the Californian cretaceous, but is not so narrowed anteriorly; is less obliquely truncated posteriorly, and the beaks are more elevated; it also differs in the surface.

From the Ripley marl, Pataula Creek, Georgia.

Peronæoderma, Poli.

P. Georgiana, n. s.

Shell small, thin, flattened; elongate, beaks subcentral; in one case in the middle, in another a little posterior; cardinal margins sloping about equally towards both ends. Anterior end prominently and narrowly rounded; posterior rounded, subtruncate; base broadly and regularly convex. Surface marked by fine, regular concentric lines. Hinge composed of minute teeth.

Length 1.2 inch; width 0.8 inch.

Intermediate in form and size between *T. Hoffmani* and *T. longa* of the Californian cretaceous and differing from both in having the posterior cardinal margin convex, instead of concave. In this character and in the rounded base, it differs also from *Œneplana*, Conrad, of the N. Carolina Cretaceous. Two specimens from Pataula Creek, Georgia; Dr. Little.

Cyprimeria, Con.

C. depressa, Con., Kerr's Rep. Geol. N. C., p. 9, Palæontology.

Dosinia depressa, Con., J. Acad., 2 s., v. 4, p. 278, pl. 46, f. 6.

Sanguinolaria cretacea, Con., *loc. cit.*, p. 277, pl. 46, f. 11.

C. Cretacensis, Con., J. Conch., 1867, p. 9.

C. cretacea, Con., J. Conch., 1869, p. 98, not C. *cretacea* (Dosinia) Zittel, Con., J. Conch., 1866, p. 102.

Dosinia Haddonfieldensis, Lea, Proc. Acad. 1861, p. 149.

Georgia specimens, from Doctor Little, differ only from those from Alabama in being nearly twice the size.

C. torta, n. s.

Shell large, discoidal, inequivalve, the right valve more convex than the left; beaks in advance of the middle; anterior end and

base regularly rounded; posterior narrowed, truncated and strongly deflected to the left side, more so below than above. Surface unknown.

An internal cast from Georgetown, Ga., from Dr. Little, measuring: length 3.0 inches, width 2.5 inches, internal diameter of valves 1.0 inch.

From *C. densata*, Con., the present species can be at once distinguished by its being shorter and in having the posterior cardinal margin nearly straight. From *C. excavata*, Morton (sp.), by being more quadrate and longer. From C. *Texana*, Roem. (sp.), in being narrower and more produced behind. I have casts from Texas of another species approaching this, certainly a different species, but too close to describe without more material than mere internal casts.

Cardium, Linn.

Subgenus *Pachycardium*, Con.

Stoliczka does not approve of Conrad's genus *Pachycardium*, and is inclined to associate it with *Pseudocardia*. The type *P. Spillmani*, if it does not stand as a separate genus, should rather be placed with *Lævicardium* than with *Protocardia*, since it has no ribs on the posterior face and only half a dozen obsolete radiating lines on the umbonal angle. It is clearly not a *Lævicardium*, from which it is separated by its very thick shell structure, its elongate form, and by the irregular transverse corrugations following the lines of growth. Most if not all of the *Lævicardia* are thin, delicate shells with polished surfaces. Whether the East Indian *bisectum* belongs to this genus or not, *C. Spillmani* should, in my opinion, be taken as the type of a separate genus, or subgenus.

Casts are not rare in a sandstone at Georgetown, Georgia. They show that the hinge teeth were enormously developed, especially the laterals; the muscular scars are very deep and, in advance of the posterior muscle, there is a thickening of the shell, broad and rounded and occupying the position of the plate of *Cucullæa*. The posterior portion of the internal margin is crenulated, but more closely than the part corresponding to the ribs on the umbonal ridge. The species is also found as casts in the brown and black marls of New Jersey, and associated with them I have a cast, more globose than any of the specimens that can be

referred to Conrad's species. It is of the same size, shows traces of the same surface markings, but is broader, rounder, and has the beaks much nearer and more incurved than the internal moulds of either the other Jersey specimens, or those of Mr. Conrad from Mississippi.

Subgenus *Trachycardium*, Mörch.

C. (T.) Carolinense, Con., Kerr's Rep. Geol. N. C. Palæont., p. 7, pl. 2, f. 1.

A larger shell than *C. Eufaulense*, Con., more circular in outline and less angulated on the umbonal ridge. It is very closely related, however, and requires care and good specimens to distinguish it.

Not rare at Pataula Creek, Georgia; Dr. Little.

C. (T.) Eufaulense, Con.

Cardium (T.) id., Con., Journ. Acad., 2 s. vol. 4, p. 282, pl. 46, f. 12.

A single valve from Quitman Co., Georgia; Dr. Little. This shell is common in North Carolina.

C. (T.) Alabamense, Gabb.

Cardium multiradiatum, Gabb, Journ. Acad., 2 s., vol. 4, p. 395, pl. 68, f. 29; *not id.*, Sby., Darwin's Geol. Obs. S. A., p. 251, pl. 2, f. 16.

All three of these shells differ from the typical form of *Trachycardium* in having smooth ribs, in which character they approach *Cerastoderma*, with which probably they might better be associated.

Granocardium, Gabb.

C. (G.) Tippanum, Con.

Cardium, id., Con., J. Acad., 2 s., vol. 3, p. 326, pl. 34, f. 8 b.
Granocardium, id., Gabb, Pal. Cal., vol. 2, p. 266.

Casts of this species are not rare in a hard brownish sandstone at Pataula Creek, Georgia.

Crassatella, Lam.

C. pteropsis, Con., J. Acad., 2 s., vol. 4, p. 279, pl. 46, f. 5.

A rare shell at Pataula Creek, Georgia, though very common in North Carolina.

C. vadosa, Morton, Syn., p. 66, pl. 13, f. 12.

C. Ripleyana, Con., J. Acad., 2 s., vol. 3, p. 327, pl. 35, f. 3.
C. lintea, Con, *loc. cit.*, vol. 4, p. 279, pl. 46, f. 5.

C. Ripleyana of Conrad is the typical form of the species, previously described by Morton; convex on its posterior cardinal margin in the young state and straight or slightly concave below

towards the posterior angle. *C. lintea* is a shell of the same species, having attained but half its full diameter. I am not sure but that *C. Carolinensis*, Con. (Kerr's N. Carolina Report, Palæontological Appendix, p. 6), should also be put down as a synonym. I only know it from the figure in the report, but the shape is very close to *lintea*, and the identity of this, I have proven by a critical comparison of the original specimens.

C. sp. indet.

A cast in brown sandstone, sent by Dr. Little from Pataula Creek, Georgia. The impression of the hinge is perfectly preserved, as well as most of the outline. It is two and a half inches long by two wide and rather flat. The posterior cardinal line is slightly arched throughout, and the posterior end broadly rounded. I do not think it belongs to any described species, but refrain from naming it until better material is found.

ANTHONYA, Gabb.

Scambula, Con.

Anthonya, G., Palæontology of Cal. 1864, p. 181, pl. 30, f. 236, a.
Scambula, Con., Journ. Conch., 1869, p. 48, pl. 9, f. 7-8.

On comparing my types of *A. cultriformis*, with those of Mr. Conrad's *S. perplana*, it proves that they are generically identical, the hinges agreeing perfectly. There is only one difference, and that of minor importance; my shell, which is very long, is slightly twisted, while Mr. Conrad's, which is much shorter, is all on one plane.

OPIS, Dep.?

O. Conradi, Gabb,
Isocardia, *id.*, G., Journ. Acad., 2 ser., vol. 4, p. 393, pl. 68, f. 21.

LITHOPHAGA, Bolt.

Lithodomus, Cuv., *Lithophagus*, Muhlf.

L. Ripleyana, Gabb, Proc. Acad., 1861, p. 326.
L. affinis, G., *loc. cit.*, p. 327.
Arcoperna Carolinensis, Con., Kerr's N. C. Rep., Pal., p. 5, pl. 1, f. 6.

I named *L. affinis*, a form shorter, more convex, and a little curved, but I do not now believe that even a greater difference in form in a boring shell can be made the basis of a specific distinction, unless repeated in a very large suite of specimens. Mr. Con-

rad's name must be placed as a synonym; his figure agrees exactly with specimens of my species, which is not rare. I have before me a large series, some showing the valves perfectly preserved, and others bedded partially and entirely in fossil wood.

INOCERAMUS, Sby.

I. Tippanus, Con. (sp.).

Pholadomya Tippana, Con., J. A., 2 s., v. 3, p. 324, pl. 34, f. 9.
I. costellatus, Con., *loc. cit.*, p. 329, pl. 34, f. 12.

A rare shell; very thin and marked by both radiating and concentric sculpture. It is very inequivalve, as will be seen by the figure 12 above quoted.

TRIGONIA, Brug.

T. Leana, Gabb.

Trigonia Gibboniana, G., Pal. Cal., vol. 1, p. 190, pl. 17, f. 178; pl. 31, f. 262, not *T. Gibboniana*, Lea, Trans. Amer. P. Soc., 2 s., v. 7, p. 255, pl. 9, f. 7, 9.

From the rather poor figure and imperfect description of Mr. Lea, quoted above, I made a doubtful identification of the Californian shell with the South American. Recently, while studying some fossils from Peru, Mr. Lea kindly placed his types at my disposal, and, among other errors I have been enabled to correct, is this one. Our two species are of the same type, but they differ very materially in the ornamentation. I have therefore renamed the Californian species.

T. thoracica, Morton, Synopsis, p. 65, pl. 15, f. 13.

From the Ripley of Pataula Creek, Georgia; Dr. Little.

T. angulicosta, n. s.

Shell small, elongate, curved; anterior end regularly convex; base broadly rounded in the middle, slightly concave posteriorly; posterior cardinal line concave; posterior end prolonged, truncate. Surface divided by a ridge, separating the corselet from the broader part; corselet crossed by transverse ribs, corresponding in number to those below; towards the end these are directed obliquely backwards. Outer surface divided into three parts; nearest the beaks it is marked on the anterior half of the adult shell by about ten or a dozen prominent ribs, most of which, after traversing half the distance from the corselet to the base, suddenly bend forward at a slightly acute angle, and terminate at the anterior

margin of the shell; posterior to these are about ten more ribs, which traverse the entire width, from the corselet to the base. On the anterior half of the basal margin are some short ribs, parallel with those last described, and which arise abutting against the lowest of the antero-posterior ribs, and reach the margin, becoming oblique forward until the most anterior becomes nearly parallel with the rib against which it originates.

Length 1.75 inch; width 1.3 inch.

From Pataula Creek, Georgia; Dr. Little.

This very peculiar shell has an internal cast not unlike *T. thoracica*, with which it is found associated; but its surface sculpture is unlike any other species with which I am acquainted. I have two fragmentary specimens before me, showing part of the surface but none of the antero-basal ribs described above. The details of the description are drawn from the impression of an entire surface in a hard sandstone.

Venilia, Mort.

V. Conradi, Morton, Syn. p. 67, pl. 8, f. 1–2.

A cast of this species occurs in the same block with one of the casts of the preceding.

Idonearca, Con.

A genus represented in the Cretaceous of New Jersey alone by about a dozen species. Some of these are as yet undescribed for want of sufficient material, and most of them are known only from internal moulds.

I. vulgaris, Morton (sp.).

Cucullæa, *id.*, Morton, Syn. Cret., p. 64, pl. 3, f. 8, and pl. 13, f. 5.

The commonest species. Casts (pl. 13, f. 5) are abundant in the marls, and are known as "squirrel heads" by the country boys. The cast is recognizable by its oblique form and prominent remote beaks. Dr. Morton described the shell from specimens from Arneytown, N. J. (pl. 3, f. 8). It is variable in its obliquity and convexity, the umbonal ridge being sometimes arched backwards and sometime straight, as seen from the side; the posterior face is nearly flat. The area is large.

I. neglecta, Gabb.

Cucullæa, *id.*, Gabb., Proc. Acad., 1861, p. 326.

This species is not rare in the marls of New Jersey, and I have seen casts from the white limestone of Prairie Bluff, Ala., apparently belonging to it. Recently I have obtained from Prof. Cook, State Geologist of New Jersey, specimens from the New Jersey white limestone (Timber Creek limestone) in which the shells are in a beautiful state of preservation. The valves are subcompressed; beak small, placed a little in advance of the middle; area narrow, about half as long as the shell, and marked by very few impressed lines; hinge thin, median teeth few and small, lateral teeth long, narrow, and few. Base and anterior end regularly and broadly curved; posterior side convex and sloping, not angulated at the base. No umbonal ridge; surface regularly convex, sloping in a little, more abruptly on the posterior side than elsewhere. Surface smooth, marked only by a few obscure lines of growth.

Length 1.75 inch; width 1.4 inch; height of single valve 0.4. inch.

I. Carolinensis.

Shell subquadrate, convex, hinge line just one-half the length of the shell; beaks small, incurved, umbones prominent and rounded; posterior slope nearly vertical; anterior end regularly rounded, retreating obliquely below; base broadly convex, most prominent in the middle. Surface in the adult marked only by irregular lines of growth; in the young crossed by very numerous and very fine radiating lines; hinge small. In the adult the middle (transverse) teeth show a tendency to irregularity, and even partial obliteration. Lateral teeth perfectly parallel with the hinge line; area small. Internal plate thin and elevated.

Length 2.0 inches; width 1.5 inch; depth of single valves .75 inch.

This species grows about the size of *I. vulgaris*, but is less oblique, with rounder outlines and a more central beak. The area is smaller, and the whole shell is more quadrate. The markings of the young shell are as minute as those of *Trigonarca Saffordi*, G., but of a different character, and the present species is proportionally shorter, more oblique, and more convex than that. *I. capax*, Conrad, is a heavy shell, remarkably thick, and will, I think, prove to be identical with *vulgaris*. I referred it to *antrosa* by

mistake in the Synopsis of Cret. Mollusca for that species. From *I. neglecta* this species can be at once distinguished by the more convex valves and by the umbonal angle.

From the Ripley Group, Snow Hill, N. Carolina.

I. Alabamensis, n. s.

Shell convex, oblique; area less than half the length of the shell; very narrow; beaks small, approximating; umbones small; anterior end broadly rounded, not retreating below; base convex in front, straight behind; posterior side oblique, uniting with the base by a marked angle; umbonal angle rounded, but narrow and abrupt; posterior face truncated; hinge narrow.

Length 1.5 inch; width 1.25 inch; depth of single valve 0.6 inch.

The nearest ally of this species is the preceding. It can be distinguished by the smaller beaks, much narrower area, the broader anterior end, the base straight behind, instead of being regularly convex, and by the strong umbonal angle and more truncated posterior end.

I have not attempted to describe the surface, since although the shell is well represented in all its details, except that, in the specimen before me, the shell substance has been replaced by a boring sponge (? *Cliona*); the shell itself has disappeared and the sponge has taken exactly its form except a thin outer film. Even two or three strong concentric lines of growth have left their impression on the sponge. This unique specimen, which might well serve as the type of two species of widely different organisms, is from the white limestone of Prairie Bluffs, Ala.

? I. antrosa, Mort. (sp.)

Cucullæa, *id.*, Morton, Synopsis, p. 68, pl. 13, fig. 6.

A very convex form, almost as short as an *Axinœa* with central beaks and a strong internal plate. The species is only known from casts, although it was described over forty years ago. Its hinge line is so curved that it may prove eventually to be a *Trigonarca*, and may even belong to Conrad's subgenus *Brevi-arca*. I have placed it under the above genus in accordance with the opinion of Mr. Conrad, with whom I have consulted on the subject.

I. sp. ?

Associated with the casts of *antrosa* are some of a more elongated and angulated form, evidently an undescribed species.

Besides the difference of outline, it has a remarkably thick internal plate running far up into the cavity under the umbones. A mashed shell from Haddonfield, found by Mr. Conrad, and evidently of this species, shows the surface to be plain, marked only by lines of growth.

The Academy's collection contains also two other species of this genus from New Jersey, represented by internal casts, but which I refrain from describing, trusting that we may obtain more material in the future.

I. Littlei, n. s.

Shell very large, oblique, gibbous, beaks large, prominent, remote, incurved; area broad; anterior end prominent, narrowly rounded, retreating below; posterior end obliquely sloping; base nearly straight, most prominent below the beaks; internal plate very large, prominent and continued up into the cavity under the beaks. Surface marked by coarse lines of growth.

Length (of casts) 5 inches; width 4.8 inches, greatest transverse diameter 4 inches.

This enormous species, not surpassed in size even by *Arca grandis*, is described from a nodular mass showing at the same time the impression of the surface and the mould of the interior. I take pleasure in dedicating this, the largest species of the family, to the State Geologist of Georgia, despite the fact that the name might be punningly suggestive of a specific character, especially inappropriate. It is from Pataula Creek, Georgia.

NEMODON, Con.

N. angulatum, Gabb.

Leda, id., Gabb, Proc. Acad. 1860, p. 94, pl. 2, fig. 12.

A re-examination of this species shows it to belong to Mr. Conrad's genus.

TRIGONARCA, Con.

T. cuneata, n. s.

Shell small, obligue; beaks slightly in advance of the centre, small, incurved, and approximated; area very small and marked by numerous transverse lines; anterior end produced, narrowly rounded, most prominent below; posterior side very sloping, the posterior end of the area being barely visible beyond the umbonal ridge; below the posterior end is narrow and caudate, almost like some Crassatellas; base slightly convex in advance, nearly

straight, or even a little concave and sloping upwards behind; umbonal ridge strongly marked; posterior face truncated; surface marked by obsolete radiating lines, and by stronger lines of growth. Hinge broad and with numerous radiately placed teeth.

Length 1.1 inch; width 1.0 inch; depth of valve 0.3 inch.

Very closely allied in generic character to *T. Maconensis*, Con., the type of the genus, but differs in its small size, the measurements being given from the largest of a large series. In shape it differs in being proportionally much larger, less produced in front and more produced behind, and in having a less rounded base.

Of about the same size as *Breviarca Carolinensis*, Con., it is a more robust shell, with a stronger umbonal ridge; is caudate behind instead of being convex; is less prominent in front, and is altogether a much more triangular shell.

Abundant at Pataula Creek, Clay Co., Georgia.

AXINŒA, Poli.

A. hamula, Morton, sp.

Pectunculus hamulus, Morton, Syn. Cret., p. 64. pl. 15, f. 7.

? *A. bellasculpta*, Con., J. Acad., 2 s., v. 4, p. 295.

The posterior extremity is *not* angulated as described by Dr. Morton. His description and figure would be unintelligible without his types. His specimens are slightly truncated posteriorly though very faintly, and others are equally round on both margins. There seems to be a considerable difference in the amount of convexity in the species, and, although I have not seen so many specimens as I would like, I think fuller series will prove that there is no difference between this and *A. subaustralis*, d'Orb. (*P. australis*, Mort., not Quoy). The only character depended on is the convexity, and that certainly varies very much in Georgia specimens sent me by Doctor Little. In fact, in some cases I am in doubt whether to call them by one or the other name, with Dr. Morton's types beside them. With about the same longitudinal and transverse diameters, the deepness of the valve of Morton's original *hamula* is .5 inch, while that of *Australis* is .25 inch. All of the casts (there are no shells) from New Jersey, are of this latter form, though Dr. Morton speaks of them as another species. The character on which Mr. Conrad separated *A. bellasculpta* is visible on some of the Georgia specimens, to a less degree than on his types from Mississippi, and on comparing the whole series, I

can find no valid ground for a specific distinction between them and *A. hamula.*

NUCULA, Lam.

N. percrassa, Con.

Journ. Acad., 2 s., v. 3, p. 327, pl. 35, f. 4.

A fine species, common at Pataula Creek, Ga.

N. Slackiana, Gabb.

Leda, id., G., Journ. Acad., 2 s., v. 4, p. 397, pl. 68, f. 37.

This was described from casts in the marls of New Jersey; the surface characters have never been obtained, but from its size and shape I have little doubt it will prove identical with *percrassa.*

NUCULANA, Link.

Leda, Schum.

It is doubtful if the names of Link should be regarded. To all intents and purposes his book was never published, although printed, until the names were resurrected by Mörch. I, however, under protest, follow H. & A. Adams, Stoliczka, Conrad, and Meek in the use of this name, regretting the habit so common of "reducing scientific nomenclature to a branch of archæological research."

N. protexta, Gabb (sp.), Meek, Check List, No. 204.

Leda, id., Gabb, Journ. Acad., 2 s., v. 4, p. 303, pl. 48, f. 23.

A single specimen from Pataula Creek, Georgia.

CAMPTONECTES, Agas.

C. Burlingtonensis, Gabb.

Pecten, id., Gabb., Journ. Acad., 2 s v. 4, p. 304, pl. 48, f. 25.

One of our finest *Pectens.* It was described from a very perfect mould in the brown sandy marl of New Jersey. Since then Mr. Conrad has found the shell in the Ripley marl of Haddonfield, New Jersey. The right ear of the lower valve is long and narrow, and has a very deep, narrow sinus. The surface is marked by regularly placed thin subsquamose plates surmounting each a small concentric ridge. Between these plates are visible very minute radiating impressed lines. This radiating

-ible on well-preserved specimens, and, while

mon in Agassiz's genus, it differs from

species in its almost invisible

Sincyclonema, Meek.

S. simplicina, Con., Meek, Check List Cretaceous, No. 196.
Pecten, *id.*, Con., J. Acad., 2 s. v. 4, p. 283, pl. 46, f. 44.

This little shell grows to a diameter of 0.6 inch, and is an abundant fossil. In the older specimens, many are marked by strong concentric squamose ridges, between which are microscopic radiating lines.

Neithea, Drouet.

N. complexicosta, n. s.

Shell moderate in size; lower valve deeply convex, upper valve unknown. Surface marked by six large ribs, regularly distributed at equal distances, between each pair of which are two smaller ones. Each rib, large and small, is divided on its upper surface into three thread like ridges; the interspaces between the ribs are regularly concave, and without longitudinal marking; entire surface crossed by minute, regularly placed subsquamose lines.

Length one inch. Locality, Uniontown, Ala.

A very pretty species, of the typical shape of *N. quinquecostata*, etc., but differing from all the described species in the character of its ribs. It is probably nearest to D'Orbigny's *N. striato-costata*, but the large and small ribs are more nearly equal in size, and they differ in the manner in which the ribs are ornamented. In our species, the broad concave interspace rounds up to nearly the full height of the rib, and only on the top does it show the two grooves which divide it into three little linear ribs. *N. alpina*, D'Orb., has the same number of large and small ribs, but they are rounded and plain on top.

Anomia, Linn.

A. argentaria, Morton, Syn. p. 61, pl. 5, f. 10.
A. tellinoides, Mort., *loc. cit.*, p. 61, pl. 5, f. 11.
A. scitiformis, Con., J. A., 2 s. v. 3, p. 330, pl. 34, f. 6.

I have compared large suites, including Dr. Morton's original specimens, and conclude that all three of the above names must go together. The differences depended on for the separation were only those of outline, and there is no possible ground for the second specific name given by Dr. Morton. Mr. Conrad's name was given to a single specimen distorted by growing on an irregular surface. The species is common at Pataula Creek, Georgia,

and grows to more than an inch in diameter. The most regular form, before the shell becomes distorted, is nearly circular, with a well-marked little beak, adjoining to, and sometimes overhanging the cardinal margin. The surface is faintly squamose and ornamented by microscopic radiating lines.

Accompanying these is another form, represented by no less than fifteen specimens agreeing well with one another. Unlike the typical *A. argentaria*, they are ornamented by a uniform pattern, clearly not the impression of a surface, to which they were attached. In form and size they do not differ from *A. argentaria*, but the ornament is a series of radiating ribs, one set large, flattened on top, and well defined; between these are interpolated from one to three smaller ribs. In most cases this alternation is well defined; though in two or three the large ribs are nearer in size to the small ones. On the typical *argentaria* this radiation is never observed, even in a rudimentary manner, and on some of my specimens it begins at the very apex; but on several the first half inch in diameter, or less, of the shell does not differ from *argentaria*, while after that the ribs begin, first on thread-like lines, finally developing to full size. In consequence of this I feel reluctant to separate the form as a distinct species, believing that more material will merge the two. I therefore content myself with proposing the name of *A. argentaria*, var. *ornata*.

PARANOMIA, Con.

P. Saffordi, Con., Journ. Acad., 2 s. v. 4, p. 290, pl. 46, f. 21.

Several specimens from Pataula Creek, Georgia.

OSTREA, Linn.

O. subspatulata, Fbs., Quart. Journ. G. Soc., v. 1, p. 61.

Five miles north of Lumpkin, Stewart County, and near Fort Gaines, Georgia; Dr. Little. The species is characterized, even when not two inches long, by a tendency to great thickening of the upper half, the lower half being a thin tongue-like process.

O. larva, Lam., A. S. V., v. 6, p. 216.

O. falcata, Morton, Syn., p. 50, pl. 3, f. 5.

Not common at Georgetown, Quitman Co., Georgia.

O. plumosa, Morton, Syn., p. 51, pl. 3, f. 9.

With the preceding.

O. pusilla, Nills., Petr. Suec., p. 32, pl. 11, f. 7, *a–c*.

O. tecticosta, Gabb, Journ. Acad., 2 s. v. 4, p. 403, pl. 68, f. 47, 48.

From Georgetown, Pataula Creek, and five miles north of Lumpkin, Stewart County, Georgia. Some of the specimens are much larger and broader than those from Tennessee and New Jersey, from which I described the species. I am convinced that not only is this shell identical with the Swiss species, but, by looking over Nillson's work, there are nearly a dozen others that will probably prove synonymous. Among these might be mentioned *Gryphæa lateralis* and *Ostrea larva*, of which the broad form, called by Nillson *O. lunata*, also occurs in New Jersey.

O. Bryanii, n. s.

Shell moderate in size, subtrigonal, oblique, irregular in outline, rather thick. Lower valve deep, upper valve flat, or more or less concave towards the basal margin. Shell usually free, sometimes showing signs of attachment near the beak; surface irregularly squamose, more so as it grows older; a few broad but not very prominent radiating lines or ribs are visible usually, though not always, on the most convex part of the lower valve. I have never observed any on the upper valve. Hinge long, triangular, deeply grooved in the middle, and strongly deflected to the left side. Inner margin crenulated, though sometimes obscurely, near the hinge. Muscular scar large.

Usual size about 1 inch to 1.5 in length; I have one specimen three inches long.

Found abundantly near Vincenttown, New Jersey, in the marl at the top of the Cretaceous, by Col. Bryan. In a few minutes, in company with that gentleman, I collected more than fifty specimens on the marl heaps of the West Jersey Marl Co.

O. Littlei, n. s.

Shell small, irregularly elongate-falcate to subtriangular; more regular in the young state; thin. Young shell marked, at least on the lower valve, by faint radiations, which become obsolete in the adult; these are crossed by unusually faint lines of growth, not squamose. Hinge elongate, triangular, deflected to the left. Associated with the lower valves are some upper ones of corresponding form and size, with the same surface markings except that they are not radiated even towards the beaks. The margins are crenulated, corresponding to the ends of the radii in the lower valve.

Length of largest specimen 2.5 inch; width 1.0 inch; depth of lower valves 0.5 inch.

From Pataula Creek and Georgetown, Georgia. I have also found some valves of this species among the undetermined oysters sent me in 1860 by Prof. Safford from the Ripley Marls of Tennessee.

Nearly as smooth as *O. plumosa*, Morton, this shell differs in its more triangular form, elongate, and somewhat bent; the lower valve is subangular and deep, and the young shell has radiations which point to a resemblance to some of the more triangular forms of *O. larva*. From that species it differs in being less falcate than the shortest and broadest specimens, and in having a mere trace of the radiations and none of the marginal plications.

O. exogyrella, n. s.

Shell subequivalve, nearly equilateral, elongate, more or less quadrate; sides subparallel, cardinal margins more or less sloping; beaks usually nearly median, sometimes a little deflected; base rounded; surface marked by distant subsquamose lines of growth not radiated at any stage; hinge broad, shallow, normally triangular, varying to nearly subquadrate.

Length 1 to 2 inches; usual proportion a third longer than wide.

From Pataula Creek and Georgetown, Georgia; Dr. Little.

I have purposely omitted a very important point in the above diagnosis, to mention it more in detail here. The shell shows an additional character, which I have failed to discover in any other true oyster, and which shows the transitional character from *Ostrea* to *Exogyra*. Fortunately, I have a good series of specimens, and every lower valve possesses a "nuclear whorl," if I may be permitted to use such a phrase in connection with a bivalve. In other words, up to a diameter of nearly a quarter of an inch, every specimen has been a well-characterized *Exogyra*. After this the direction of growth changed to a right line, and the spiral is partially imbedded in the succeeding layers, or projects as a slightly deflected tip or beak on an unusually symmetrical oyster. This spiral is on the normal side of *Exogyra*, and under the deflected beak there is a slight emargination, a corresponding convexity existing on the opposite side.

This character is of the greater interest, since it is a transition
[illegible]ters of the species variously known as *Ostrea*,
[illegible]steralis, Nilsson, Petr., Suec., pl. 7, f. 9.

10. (*G. vomer*, Morton, Syn. Cret. p. 54, pl. 9, f. 5.) This shell is a well-marked *Exogyra* in its young state, but in some cases in the adult the spiral beak is entirely covered up. Mr. Conrad proposed for this group, although I think on insufficient grounds, the subgeneric name of *Gryphostrea* in the genus *Ostrea*. This last species survived to the Eocene, where it is known in the Paris Basin as *O. eversa*, and in Maryland as *O. sub-eversa*.

GRYPHÆA.

G. vesicularis, Lam. (sp.), Bronn, Leth. Geog. pl. 32, f. 1.
Ostrea, id., Lam., Am. Mus., v. 8, p. 160, pl. 22, f. 3.

Common at Georgetown, Georgia; Dr. Little.

G. Thirsæ, Gabb, Proc. Acad., 1861, p. 329.

This is a rare species, and seems to be confined to the neighborhood of Alabama and Georgia. I described it from the former State, and now have it from near Fort Gaines, Georgia, whence it was sent by Dr. Little. It is intermediate between the narrowest forms of *G. vesicularis* and *G. pitcherii*. From the former it can be distinguished by the sides being narrowed and sloping nearly straight from the umbone, which is narrower and more prominent than is Lamarck's species. From *G. pitcherii*, which it most resembles, it can be distinguished by being less distinctly lobed laterally; by the hinge area of the lower valve being broader and flatter, and by the beak being very minute instead of being large and incurved.

EXOGYRA, Say.

E. costata, Say, Journ. Phila. Acad., 1 ser., vol. 2, p. 43.

To the already long synonymy of this species must be added *E. interrupta*, Con., Journ. Acad., 2 s. v. 3, p. 330, pl. 34, f. 15.

I have this latter, which is only an attached lower valve of *E. costata*, of every size and of every degree of attachment from an almost total obliteration of the ribs, to a perfectly free and typical *costata*. They are marked Georgetown, and five miles north of Lumpkin, Stewart County, Georgia.

Hemiaster occidentalis, Gabb.

This echinoderm was described by me as coming from the Cre- Oregon. It was given me by a friend, who at the same

time told me that was the locality. Since then an extensive acquaintance with the Cretaceous rocks of the west coast of North America, including not a little with the geology of Oregon, renders me doubtful of the accuracy of the information. The specimen is preserved in a light-colored limestone, entirely unlike anything I know of in our Pacific States, but which looks suspiciously like some Cretaceous rocks I have seen from Peru. It may consequently prove to be a South American fossil, though this is only a conjecture.

PALIURUS. New Genus.

A free serpuloid tube, usually with a triangular cross section externally; circular internally; tube straight or slightly twisted or bent.

P. triangularis, n. s., pl. 17, f. 11, 12, 13.

I propose this name for a common little annelid in the white limestone, found especially abundant at Vincenttown, New Jersey. It is free, and, as above described, has an external triangular cross section; the two ends are open, and the apertures are circular. The carinæ are subangular or rounded, the sides more or less deeply grooved, and the entire shell, usually about three-fourths of an inch long, is slightly twisted or irregularly curved, though varying little from a straight line. The diameter is about .06 or .07 inch.

DECEMBER 5.

Mr. VAUX, Vice-President, in the chair.

Forty-two members present.

The following papers were presented for publication:—

"Our Sidereal System and the Direction and Distance of its Centre." By JACOB ENNIS.

"On some Extinct Reptiles and Batrachia from the Fort Union and Fox Hills Beds of Montana." By EDW. D. COPE.

On Ozocerite.—Prof. LEIDY remarked that the fine collection of specimens of Ozocerite, and minerals with which it is found associated, presented this evening by Mr. Paul Dobel, through Dr. F. Migerka, the Austrian Commissioner, were well worthy the attention of the members. The Ozocerite, Erdwachs or mineral wax of the Germans, is found in association with clay, sand, and salt, at Boryslaw, in the Carpathians, Galicia. The collection consists of a fine series of the Ozocerite of different varieties: the ordinary brown resin-like kind; a lemon-yellow flaky form; another lemon-yellow but fibrous kind; a black carbonaceous form, etc., with specimens associated with rock salt, and others with clay and sandstone. Besides these there are a number of specimens obtained from the crude material; a mass of chocolate-brown hue; another undistinguishable in appearance from ordinary yellow beeswax, and a third looking like white wax or like paraffine.

On Hyraceum.—Prof. LEIDY remarked that the large, black bituminous-looking mass presented this evening, through Mr. H. C. Coates, Commissioner of the Colony of Cape of Good Hope, is the substance called Hyraceum, and is said to be the inspissated urine of the *Hyrax capensis*. The animal is reputed to inhabit gregariously, rocky places at the Cape of Good Hope. The accumulated urine in hollows of the rocks, gradually evaporating, is supposed to give rise to the product in question. It is reported as having been employed in medicine with the same effect as castoreum.

Prof. Cope remarked that a material resembling the concretion made by the urine of Hyrax was found in the fissures of the rocks in New Mexico. It was probably the fecal and renal deposit of the wild rat, *Neotoma*.

On Itacolumite.—Prof. W. P. BLAKE remarked that the Mineral Department of the National Museum at the Centennial Exhibition had recently received some specimens of flexible sandstone, re-

ported to be from Mariposa County, California, which are interesting and worthy of note by reason of the new locality, and as showing the peculiarities of this kind of sandstone in a marked degree. The specimens are, also, unusually fine, some being over thirty inches in length, and only two square inches in section. The color and the structure appear to be the same as in flexible sandstone from other localities. Thin and small scales of silver mica are abundant. It bends with little resistance up to a certain point, and without elasticity, but is rigid beyond that point. When held up by one end and shaken, the motion is transmitted in wave-like vibrations as in a cord, but the limit of movement is sensibly felt like a blow or shock. A specimen thirty-two inches in length may be bent seven and a half inches to one side or the other of a straight line. The freedom of movement is greatest at right angles to the plane of lamination. The specimens are also capable of being sensibly extended when pulled. In a specimen thirty-two inches long the extension amounted to about half an inch. No examinations under the microscope have been made, as they should have been, to show the structure. The freedom of movement up to a certain point, and the rigidity beyond that point indicate that there is a tolerably uniform distance between the grains of sand and a certain amount of movement possible among them, and that by bending, the grains are brought into contact with each other. The theory of the late Prof. C. M. Wetherill that the grains of sand are shaped like dumb-bells was referred to with a doubt of its correctness. The part which the scales of mica play can only be shown by the examination under a microscope of carefully ground sections of the stone, which might perhaps be prepared for cutting by solutions of soluble glass.

Prof. LEIDY stated that he had examined Itacolumite microscopically without being able to detect anything like the dumb-bell structure described by Dr. Wetherill. He supposed that the intermingling of grains, differing in translucency and color, gave rise to the impression of a dumb-bell arrangement. Thus a pair of adherent translucent grains surrounded with smaller colored ones would give rise to such an impression.

DECEMBER 12.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-four members present.

DECEMBER 19.

Mr. VAUX, Vice-President, in the chair.

Thirty-five members present.

Mineralogical Notes.—Mr. JOSEPH WILLCOX said that the two fine crystals of scapolite, which were presented this evening by Mr. Vaux, were found at a new locality for this mineral, in St. Lawrence County, N. Y., and that a specimen from the same locality had recently been received in this city which weighs about 25 pounds, and is probably the largest scapolite crystal ever found.

He also referred to a specimen of quartz on the table from the well-known locality of green quartz at Blue Hill, in Delaware County, Pa. This specimen had been exposed to the weather for a few weeks, and had lost nearly all its green color. This green quartz is found in several veins of chlorite, much decomposed, and each of different intensity in color. The quartz occurring in each vein corresponds in color to the matrix.

Impurities in Drinking Water.—Mr. WILLCOX also stated that, during the last eight years, whenever the Schuylkill River has been covered with ice, he observed that the water supplied by the city possessed a disagreeable odor and taste, like chlorine. Large quantities of chloride of lime are daily used at Manayunk and at the Wissahickon for bleaching purposes, and the chlorine gas is liberated from it by the application of alum and sulphuric acid. A large portion of the chlorine gas subsequently escapes from the water before it reaches Fairmount; but when the river is covered with ice, this process of purification is retarded, and the offensive element is practically conveyed, in a covered trough, from the mills to the pumps that supply our city with water. He was not competent to state if chlorine in this condition is prejudicial to health. Being a powerful disinfectant it may be a providential interposition for the prevention of disease that might be caused by the foul material that is carried in such profusion through the sewers into the Schuylkill River, and which, on account of the ice, would otherwise be transported into our water-pipes in its original impurity.

On Excrescences and Excentric Wood Growths in the Trunks of Trees.—Mr. THOMAS MEEHAN said that on many trees were peculiar excrescences, which, up to a few years ago, had been referred primarily to insect origin. Cutting these through lengthwise there was no appearance of this agency. There were layers of wood of annual growth, just as in the normal parts of the tree.

Examining some oak knots of this character, and finding pulverulent fungoid matter abundant on the surface, he said he had introduced some of these to the Academy a few years ago, and suggested this as a substitute for the insect theory, but subsequently Professor Farlow had kindly examined them critically and found no trace whatever of fungoid matter in their structure. This left us wholly in the dark as to the exact origin of these stuctures.

It was worth noting that these excrescences were often of a uniform character in each species of tree. In many cases, no matter how large or how old they were, they would separate from the parent stem easily by a short sudden blow. He had made collections of these and in most cases found great uniformity. In *Quercus obtusiloba* they were depressed globose, in *Fagus sylvatica* (American beech) they were convex and oval, with the narrow ends crosswise with the trunk. In the *Acer rubrum* (red maple) they were oval but drawn out lengthwise. In the common weeping willow they varied very much in size, sometimes being as large as a bushel measure, but always knocking out easily as in all named before. In the common cherry (*Cerasus avium*) and the paper mulberry (*Broussonnetia papyrifera*) the excrescences were also very irregular in form, and seemed to have a stronger attachment to the parent stem than the others. The apple had very small and numerous ones in some species; and it was from an examination of these, he said, that he had derived the key to the whole subject. On the bark of some kinds of apple trees numerous small pea-like projections would exist on the bark within a space of a few inches. On cutting open, these were found to be not vesicular, but to be filled with hard and perfect wood. A careful examination showed that these woody masses took their rise seemingly from the liber, to which, in the newly formed cases, they would be found still attached by a small thread-like vessel.

In order to understand their formation, it was necessary to understand how wood was made. In many trees the annual layer was so regular, and seemed to be placed so nicely, that one not a botanist might be pardoned for believing that the sap was changed to woody matter in the leaves, and the new formed matter sent down, sliding over the old layer like the sections of a telescope; but though the food was prepared by the leaves in a great measure, the actual growth was made by the germination of some of the cells along the whole outside wall of last year's wood beneath the inner bark. In his own observations of this process he had taken the common cherry for his experiments. The germination of the cells takes place here about the middle of June. He takes a healthy cherry tree and strips it entirely of its bark to any length desired. At that season a viscid liquid will be found covering the woody surface in abundance. The stripped part is

covered with a cloth to prevent evaporation, and in a few days numerous dots, like needle points, will be seen about the sixteenth of an inch apart all over the surface. These are the young cells which have germinated from those of last year. They continue germinating, one from the other, until they meet, when they unite and form a complete surface. In the fall a layer of wood will be found just as thick as in the part of the tree not disbarked, and a single layer of liber, with its outer coat of cellular matter—perfect bark—will have been formed over the whole. The entire formation of wood and bark can thus be seen by the ordinary observer, without the necessity of any nice microscopical work. Other people have tried the experiment with other trees. He has seen large apple trees that have had their bark peeled wholly off from their trunks, at the season named, make an entire new layer of bark and wood, not only with no injury to the tree, but to its manifest enjoyment; but his own experiments were confined exclusively to the cherry.

By this experiment we learn that there is no difference primarily in any part of the annual covering. The same cell may become permanent tissue or generating tissue—and from the generative tissue may come before the season of growth closes every form of structure known to anatomists, from pure wood to the outermost cuticle of the bark. How these cells become differentiated may be passed over here. We know that cell-growth is not always uniform in its operations. The law that changes the outermost series of newly made cells into liber need not necessarily operate so exactly as to make them perfect to this end—a few may be thrown off into the liber as generative tissue—and, granting this possibility, we see how the woody granules in the apple bark are formed.

How cells usually of one character may be made to assume others is shown in the formation of adventitious buds. Sachs (Text Book, Eng. ed., p. 563) thinks that few dicotyledons produce adventitious buds. The shoots that often spring from the bark of the older stems of trees, he says, are probably from dormant buds which have retained vitality, though buried from the first growth of the stem. This sort of growth is true. In *Gymnocladus* the buds formed the first year in the axil of the leaves are in a linear series of three or more, of which but one is generally seen above the surface; but after many years, if the bark be gently shaved, these will be found just beneath the surface as they were the first year, having kept along their hidden growth all that time. In some magnolias (*M. acuminata*, *M. tripetela*), besides the axillary bud one forms exactly horizontal to it, on the side opposite to the direction of the spiral growth. This bud is rarely seen above the surface, and has not been before made known to botanists as I believe, but may always be found beneath the surface of the stronger shoots when the bark is gently shaved, no matter how

great may be the age, unless, as sometimes happens, some accident should favor its development to a perfect branch. These are the sort of buds referred to by Prof. Sachs, and of course make up their share of new branches when time comes to favor them. He knew of no dicotyledonous tree that could not be made to throw out numerous adventitious buds from any part of its surface by sawing off. In our common street maples this was every-day experience. A few inches below the cut generally died back from evaporation of the juices; but when the shoots pushed out they came by the dozens in the space of a few inches. Now in the original shoot—the first year's growth—there would be found in a vigorous specimen seldom more than six buds in a length of six inches; but in a strong six year old branch of maple (*Acer dasycarpum*) cut back he had seen as many as fifty shoots in that space. He exhibited a one year shoot of *Catalpa*, where the normal buds were ten inches from each other. In old branches cut back in early winter, so that the surface may harden a little before spring, and thus the tree lose little of its juices by evaporation, shoots will come out numerously from any part of the foot space between these original buds.

It was interesting, however, to note that in no case that he knew of would adventitious buds be produced between the nodes from a one year old branch. Such a branch cut beneath the node invariably died to the next. It would seem as if the demand on the nutritive powers of the plants for the axial elongation had left the generative tissue with less power than in subsequent years they may possess.

How cells which under some circumstances become permanent tissue, or at best generative tissue, may become the parents of adventitious buds and shoots was well shown in cutting down horse chestnuts, some poplars, and some birches. As before said, during the season following the first year, no adventitious buds will form between the nodes, when the branch is shortened; but in the older trees, the new cells from the generative tissue all along the exposed part or surface of the stump form adventitious buds and branches. The whole circle between last year's wood and the bark produces a forest of branches. He had seen this also, he said, in Cotyledons and other succulents under greenhouse culture.

From these considerations there was no reason why cells, predestined, under ordinary circumstances, to be merely bark cells in their change from wood cells, should not occasionally retain enough of growth force to carry on a feeble wood constructing system of their own.

We thus come naturally to the origin of these woody excrescences. Imperfectly formed liber cells, still retaining their generative power, would make a growth the next season, forming a layer of wood and making its own cortical layer, simultaneous with the normal wood growth of the tree, assimilating from the same

store of reserve material that the normal growth does. The proof of all this lies in the cutting through longitudinally of one of these excrescences when it will be found to have made one more annual layer from the point of its origin than the tree itself, showing that the origin dated from a double set of germinating cells in that one year.

Where, as in the weeping willow and cherry, the excrescences are protruded much beyond the normal diameter of the tree, the annual layers of wood are on the average thicker, through having assimilated a greater share of food; as is generally the case with cells situated above an obstruction, for instance, as when a wire is fastened around a branch, a ring of bark taken off, or other means employed to interfere with the connection between root and foliage.

Mr. Meehan further said that explanation of growth in connection with these excrescences, explained also much that was usually inexplicable in the various excentricities of growth. He exhibited a specimen of a trunk of a *Bauhinia*, presented to the Academy by the Brazilian Centennial Commission, in which the wood seemed a mere fasciculus of many separate stems, forming a sort of ligneous mosaic work. The trunk was about six inches in one direction, and two in the other. The first year's growth, round the small pith, was circular; the subsequent ones irregular through the varying powers of growth in the germinating tissue. Very often, but a very small section of the previous year's circle of wood would germinate, in which case the whole growth would be made from that point pressing round and over, with great luxuriance, and enveloping the bark as well as wood of the previous year. Mr. Meehan thought it quite likely that the cases of *Wistaria* with bark between some of the annual layers of wood, might be explained in a similar way.[1] The subject of the excentricity of the annual layers of wood in trees could also be understood, keeping in mind the generating tissue, and its varying powers of life and transformation. Anything which favored nutrition in one part of the mass of cells more than in another, would increase their power of growth, and induce thicker layers at that point than in others. A very hot sun on one side, or in one season on one side, or on particular spots on one side, inducing an inordinate evaporation from those parts, would weaken the vital power of the cells just there. The germination would be weak, and the woody layer thin. Cold winds on one side in very

[1] Since making the above remarks I have had brought to my attention that in 1873, M. Licopoli, of Naples, in some publication not known at this writing, has suggested that the appearance of bark mixed with the wood of *Wistaria* is due to the formation of woody matter by the bark, which wood then continues to grow, and leaves the bark, as it were, behind the wood, instead of being pushed steadily before, as in normal wood growth. Although sure that my facts were as I detailed them, it is pleasant to have the confirmation of my views of these abnormal wood growths in this independent way.

cold weather would have the same effect in some cases. The continual blowing of trees always in one direction might favor assimilation by the cells on one side more than on the other, or even the closer proximity of some cells to healthy foliage or vigorous roots, would give them a great advantage over others, and the layer would thicken. In some plants there was pretty equally divided power. The whole mass of tissue seemed equally and regularly vitalized, and the generative tissue formed a new layer of wood of about equal thickness all round. But in other trees some masses of cells seemed to easily draw from the others more than their share, and the latter were correspondingly weakened. This was beautifully illustrated in the Hornbeam (*Carpinus Americana*). Here the irregularities in the thickness of the annual layers defied all system. They might be very thick at one point, and yet at an inch or two above or below the same layer, be very thin. The red cedar (*Juniperus Virginiana*) exhibited similar characters, except that the loss of generative power in some of the cells was more uniformly in a direction lengthwise with the stem. In a section he had recently examined the annual layers were tolerably regular for fifteen years. A young tree of the same species had then grown up close to it on one side, and the annual layers became thinner, finally ceasing there. The other sides grew on as before, the layers tapering, with the weakened vitality, to where the tissue was wholly at rest. So in various parts of the outline could be noted the time when various parts of the generative tissue lost vital power. In one part of the section, in a direct line from the centre, there was a continuous and nearly regular annual layer for over fifty years; but in many directions, by counting the rings or layers, the time could be traced when the tissue ceased to be generative or almost so, fifteen, eighteen, twenty-eight, and so on. All the cases of peculiar excentricities, *Hedera*, *Toxicodendron*, *Ampelopsis*, and the peculiar cases of ordinary timber trees, could be explained by this, so far as to note that the immediate law was a loss of generative power in the cells of the annual layer. Of course, the indirect causes leading to this would be very numerous, and left room for much more investigation. The remarks were made as much as possible in language divested of botanical technicalities for the benefit of those interested in the many other branches of science present; but those who would pursue the subject of wood-growth, as described here and applied to the explanation of excrescences and eccentricities, are referred to Sach's Text Book of Botany.

Mr. Martindale inquired if Mr. Meehan had noted the square growth of a coniferous trunk from the Pacific coast, on exhibition at the recent Centennial, and if that growth could be accounted for on his explanations?

Mr. Meehan replied that he had examined that trunk. It was square only at the lower end. It was of *Picea amabilis*. At the four corners the annual layers were thicker than at the sides. He

had no doubt that in that case, and in similar ones if they were repeated, four strong roots had grown out at nearly equal distances, and the mass of cells nearest to these roots had an advantage in nutrition. We saw this in the trees of our own forests. Just in proportion to the vigor of the roots below was the thickness and irregularity of the trunk for a considerable distance above. If these trees had but four main roots of equal strength at equal distances, a portion of the trunk would be about square.

Mr. J. H. Redfield inquired whether Mr. Meehan would class cypress knees among the excrescences he had described?

Mr. Meehan replied not, as they were an outgrowth from the normal woody system of the roots of the tree, while the excrescences originated in the liber, or the tissue very closely allied thereto.

Pickeringite from Colorado.—Mr. E. GOLDSMITH stated that he has observed, in the Mineralogical Collection of the Academy, a white mineral which had not been determined. His examination, which was principally a chemical analysis, proved it to be the above-named species. As Peru and Nova Scotia are localities where this mineral has been found previously (see Dana's Descriptive Min., p. 653), this seems to be the first observation of Pickeringite in the U. S. Dr. John LeConte collected it. The particular note on his label is, near Monument, near Colorado City, Col. Terr.

The mineral is crystallized in very thin needles, which can only be seen when it is broken; these crystals keep within the mass well. Externally it is apt to become powdery. Its taste is astringent.

Hardness about = 1.
Specific gravity in oil of turpentine = 2.0105
" " " water = 1.7290

In the flame reaction he noticed the presence of sodium and potassium. The last element has been noticed by How in the Pickeringite from Nova Scotia. Sodium seems not to exist in the compound found in Nova Scotia or Peru.

The blowpipe reaction indicated water, alumina, and sulphuric acid.

The qualitative analysis proved also the occurrence of a minute quantity of proto and sesquioxide of iron, and magnesia was recognized to be in the solution.

The quantitative analysis gave this result:—

	$\dot{S}$ = 38.69	per cent.
	$\dot{A}l$ = 11.90	"
	$\dot{M}g$ = 4.89	"
(Ka)	$\dot{N}a$ = 0.68	"
	Sand = 1.90	"
By difference	$\dot{H}$ = 41.94	"
	100.00	"

He was inclined to believe that the average sample had lost some water of crystallization.

An attempt was made to separate the potassa from the soda, which were both in combination with chlorine, but the reagent applied failed to affect it. The chloride of potassium could have been but a trace. Having also observed that the quantity of iron in the mineral was small, it was considered useless to measure it.

Epsomite on Brick-walls.—Mr. Goldsmith remarked, with the beginning of the cold season the brick-walls of Philadelphia often become coated with a whitish incrustation. The supposition was current, to some extent, that the incrustation was a mixture of chloride and nitrate of sodium.

Mr. W. H. Dougherty, of this city, collected, in the beginning of December, a sufficient quantity of it, and examined it chemically; to his surprise he found that it reacted strongly on magnesia and sulphuric acid. The gentleman handed to Mr. G. some of the substance, which the latter redetermined. The result was the same. The epsomite contained besides, as an impurity, a small quantity of sodium, potassium, and chlorine.

Mr. Dougherty endeavored to trace out the origin of the epsomite, and analyzed some mortar which he collected from a wall that had on its surface this soluble salt. The reactions obtained proved that it was present. When fresh mortar was treated in the same way the presence of magnesia was recognized, but sulphuric acid was not found in it.

The idea that sulphuric acid, in a free state, could be present in bricks is improbable; hence, a plausible hypothesis is offered to explain its presence: The coal and gas used in the city contain small quantities of sulphur, which, when burnt, is oxidized into sulphuric acid, and this, being precipitated on the wall, will eventually also touch part of the mortar, out of which it will extract the magnesia, and thus form epsomite. From this explanation it may be inferred that the lime in the mortar cannot be any longer caustic, for caustic lime will not permit the sulphuric acid to combine with magnesia, as long as it is present in the mixture. The lime in mortar is converted into silicate of lime, but whether the magnesia is also changed into a silicate is, I presume, not known at present.

DECEMBER 26.

The President, Dr. RUSCHENBERGER, in the chair.

Seventy-four members present.

Following papers were ordered to be printed:—

NOTES ON FISHES FROM THE ISTHMUS OF PANAMA, COLLECTED BY DR. J. F. BRANSFORD, U. S. N.

BY THEODORE GILL.

The present article is devoted to an enumeration of fishes collected by Dr. Bransford during a recent survey of the Isthmus. Although small in numbers, the collection is of considerable interest, inasmuch as there are in it several new species, and among them representatives of two genera which have not before been known to be represented in that country. These, for the Isthmus, new generic types, are *Platypœcilus*, hitherto exemplified by a single Mexican species, and *Piabucina*, previously known only from two species found in Guiana and Venezuela.

I have adopted the formulas employed by Dr. Günther, to enable comparisons readily to be made with the descriptions of the new species.

GOBIUS SOPORATOR.

Synonymy.

Gobius soporator, *Cuv. and Val.*, Hist. Nat. des Poiss., vol. xii. p. 56; *Guich.*, Hist. Cub. por de la Sagra, Poissons, p. 127; *Günther*, Cat. Fishes B. M., vol. iii. p. 26; *ib.* Trans. Zool. Soc. London, vol. vi. p. 388 ("Atl. and Pac. Panama.")

One specimen was obtained at Washington Station.

CICHLASOMA CŒRULEOPUNCTATA.

Synonymy.

Acara cœruleopunctata, *Kner and Steindacher*, Sitzungsber. d. bayer. Akad. dl. W., 1863, p. 222; *ib.*, Abhandlungen d. bayer Akad. der W., II. Cl., b. x., p. 16, tab. 2, fig. 3. 1864; *Günther*, Trans. Zool. Soc. London, vol. vi. p. 449, 1868.

A number of specimens were obtained from different localities, viz, Empire Station, February, 1875; Rio Frijoli, March, 1875; and Bahia Soldado, March, 1875.

PLATYPŒCILUS MENTALIS.

D. 10. A. 9. V. 6. L. lat. 25. L. tr. 7.

Body regularly compressed backwards, and moderately elevated; its greatest depth being in advance of the dorsal fin, and contained three and a half times in the total length, without the

caudal; head less compressed than the body; the width of the interorbital space is less than one-half the entire length of the head; the length is contained three times and a half in the entire length without the caudal; the diameter of the eye considerably exceeds the length of the snout, and equals one-third the length of the head; the dorsal fin is moderate, higher than long, and its origin is about midway between the snout and the middle of the caudal fin; anal fin small; its origin is opposite the middle of the dorsal fin; caudal fin round, equal to the length of the head; its depth at base equals three-fourths the length of the head; the pectoral fin extends considerably beyond the root of the ventral; the ventral does not reach the origin of the anal. The color is a uniform brownish-olive, with no caudal spot; a linear band crosses the chin parallel with the lip; the dorsal has a deep, black, band-like spot near the base crossing the anterior half.

A single female specimen, 65 millimetres long, was obtained from a stream on the Atlantic side of the Isthmus.

Inasmuch as this species agrees with *Platypœcilus maculatus* generically in the position of the ventral fins under the dorsal, and thus differs from all related forms, it appears to be congeneric with it. It, however, differs much in the comparatively elongated body and less number of rows of scales between the dorsal and anal, as well as in other respects.

ASTYNAX ÆNEUS.

Synonymy.

Tetragonopterus æneus, *Günther*, Proc. Zool. Soc. London, 1860, p. 319; *ib.*, Cat. Fishes B. M., vol. v. p. 326; *Kner and Steindachner*, Abhandl. k. bayer. Akad. W., II. Cl., b. x. p. 46; *Günther*, Trans. Zool. Soc. London, vol. vi. pp. 394, 478.

Numerous small specimens, which would at least have been referred by Mess. Kner and Steindacher to this species, were obtained from Empire Station, Bahia Soldado, and the Rio Frijoli.

PIABUCINA PANAMENSIS.

D. 10. A. 12. L. lat. 30. L. trans. 8.

The height of the body equals one-fourth of the length, excluding, and one-fifth of the total, including the caudal; the head enters a little less than three and a half times in the length, exclusive of the caudal; the lower jaw projects slightly beyond the

upper; the supramaxillary extends below the anterior half of the eye; the diameter of the eye equals about three-fourths of the interorbital space, is somewhat greater than the length of the snout, and about one-fourth the length of the head; the middle postorbital about as high as long; the dorsal fin commences nearer the snout than the sinus of the caudal fin, and behind the vertical from the ventrals; caudal emarginated, scaly at its base; the pectoral fin equals about one-fourth the length of the head, and its point is about intermediate between its upper axil and the ventral; ventrals decidedly shorter than the pectorals. The color is yellowish-brown, with a dark lateral band extending from the post-humeral spot to a dark area at the base of the caudal; the dorsal fin has a black spot near the base, which crosses the anterior rays.

Three specimens—an old and young—were collected in the Rio Frijoli, and an adult in another stream emptying into the Atlantic. The two adults were 82 millimetres long.

This species is interesting on account of its western and northern habitat, *Piabucina erythrinoides* having been discovered in Lake Maracaibo, and *Piabucina unitæniata* in British Guiana. The present species is most nearly related to the former, but differs in the smaller scales and otherwise.

RHAMDIA BRANSFORDII.

D. I. 6. A. 12.

The head is covered with soft skin above; the adipose fin is long, and enters two and two-thirds times in the total length without caudal; its distance from the dorsal is only equal to half the length of the dorsal; the maxillary barbels extend behind the anus, or the origin of the adipose dorsal, and the outer ones of the mandible beyond the inner axil of the pectorals; the height of the body below the dorsal equals nearly one-fifth of the total length without the caudal; the head forms less than one-fourth of the length without the caudal; the lower jaw is considerably the shorter; the band of intermaxillary teeth is about six times as wide as deep; the eyes are nearly midway between the snout and subopercular margin; and the diameter is contained two and a half times in the width of the interocular space; the dorsal fin is scarcely higher than long; its first spine is quite slender, and equal to about three-fourths of the head's length; the pectoral

spine is half as long as the head; a minute porus axillaris is developed; the posterior rays of the anal fin, when depressed, fall some distance short of the end of the adipose fin; the free portion of the tail is somewhat higher than long; caudal fin forked, with both lobes rounded; the length of the lower is contained five and a half times in the total; the color is a uniform purplish-brown; the dorsal fin lightened by the usual basal cross-band. A single specimen was obtained at Camp Marie Caretta, January, 1875.

The specimen is distinguished from those of *R. Wagneri* described, by the proportions, although it is possible that it may be conspecific with them.

LORICARIA URACANTHA.

Loricaria uracantha, *Kner and Steindachner*, Abhandl. bayer. Akad. Wiss., II. Cl., b. x., p. 56, taf. 6, fig. 3; *Günther*, Trans. Zool. Soc. London, vol. vi. pp. 393, 478.

Eight specimens were obtained at Empire Station.

LORICARIA BRANSFORDI.

D. 1, 7. A. 6. V. 1, 5.

Snout (probably broad?—broken off); eye small, its vertical diameter being about equal to half of the width of the interorbital space; the space itself is flat, and the orbits are surmounted by slight crests; the posterior portion of each orbit has a slight notch tending upwards; (teeth probably small, and numerous in both jaws?); lower side of the head naked; opercula and the marginal scutes of the head with a broad, dense band of nearly equal erectile bristles; scutes of the neck with two obsolete carinæ; L. lat. 28; there are six lateral scutes between the pectoral and ventral fins; the scutes of the thorax are polygonal and in irregular rows; those of the belly scale-like—*i. e.*, with convex margins—and arranged in transverse rows, somewhat arched forwards; the two lateral ridges coalesce on the eighteenth lateral shield; the origin of the dorsal fin is nearly above the middle of the base of the ventral fin; the caudal fin is slightly emarginated, with its upper lobe somewhat produced, and with the upper spine somewhat swollen at its basal half, the lower lobe obliquely truncated. The color is yellowish-brown; the fins with their rays only banded or spotted.

A single specimen, somewhat over 130 millimetres long, was obtained at Empire Station. The snout and jaws have been lost, and consequently some important characters require to be ascertained. The species is, however, evidently nearly related to the *Loricaria lima* of Kner, but is distinguished by differences in proportions. I take pleasure in connecting with it the name of the discoverer, Dr. Bransford.

CHÆTOSTOMUS CIRRHOSUS.

Synonymy.

Hypostomus cirrhosus, *Val.*, Voyage Amér. Mérid. par d'Orbigny, Poiss., pl. 7, fig. 3; *Cuv. and Val.*, Hist. Nat. Poiss., t. xv. p. 511.

Ancistrus cirrhosus, *Kner and Steindachner*, Abhandl. bayer. Akad. Wiss., II. Cl., b. x. p. 61.

Chætostomus cirrhosus, *Günther*, Cat. Fishes B. M., vol. v. p. 247; *ib.*, Trans. Zool. Soc. London, vol. vi. pp. 393, 478.

Two specimens were obtained, one at Camp Marie Caretta, March 27, 1875, and the other at Empire Station.

ON SOME EXTINCT REPTILES AND BATRACHIA FROM THE JUDITH RIVER AND FOX HILLS BEDS OF MONTANA.

BY E. D. COPE.

LÆLAPS, Cope.

Proceed. Acad., Phila., 1866, p. 275. Extinct Batr. Rept. N. Amer., 1869, p. 100.

Two species of this genus were described in the latter memoir above cited, the *L. aquilunguis*, Cope, and *L. macropus*, Cope, both from the greensand or Fox Hills group of the cretaceous of New Jersey. A considerable portion of the skeleton of the former was described, including the peculiarities of the ankle-joint, which led me to the conclusion, previously unsuspected by naturalists, that the *Dinosauria* present affinities to the cursorial birds. The teeth of this species were described and figured, but in the *L. macropus* they were, and still remain, unknown.

In a preliminary report on the extinct vertebrata obtained by the writer on the Upper Missouri the present year, three additional species were referred to this genus, viz.: the *Lælaps incrassatus; L. explanatus*, and *L. falculus*. Their characters were ascertained from teeth alone, so that their pertinence to the genus *Lælaps* is not fully assured. A fourth species of carnivorous dinosaurian was described under the name of *Aublysodon lateralis*.

One of the most valuable specimens obtained by my expedition of 1876, is the nearly entire left dentary bone of the *Lælaps incrassatus*, which exhibits the teeth of its two extremities. The different forms of the teeth of the carnivorous *Dinosauria* graduate into each other by such easy stages, as to have given rise to question in reference to their proper interpretation; whether they indicate different species or only different positions in the dental series. In describing the *Aublysodon horridus*, the first known of the species of the Judith River beds, Dr. Leidy expressed the suspicion that a certain form characterized the teeth in the position of incisors, another those in the position of canines, and another form the remainder of the series. The teeth of the last kind have the form of those of *Lælaps;* in others the posterior serrulate cutting edge is

latero-posterior, the posterior aspect being thickened, and either transverse or convex in section. In the supposed canines the anterior serrulate edge is wanting, or represented by a second posterior edge parallel with the original one, thus forming a compressed chair-shaped crown. Numerous specimens of all these forms were obtained by the expedition.

Examination of the dental series of the *Lælaps incrassatus* shows that the antero-posterior diameter of one or two teeth in the position of canine, becomes oblique in the curved long axis of the dentary bone. The transverse diameter is also greatly increased so as to equal or even exceed the antero-posterior; the serrate edges are opposite to each other. A tooth of this type was the first of this species which I observed, and the name has reference to its peculiar form. A tooth in the position of first or anterior incisor, differs in having the anterior serrate crest removed to the middle of the inner aspect of the apical portion of the crown, while the posterior edge retains its usual position. Further posterior transfer of the anterior cutting edge and a grooving of the posterior face, would produce a tooth of the form suspected by Leidy to be the canine of *Aublysodon horridus*, while the canine just described is different from any tooth referred by Leidy to the same species. But a large tooth found in immediate association with the jaw, but separated from it, has the posteriorly truncate form described by Leidy as typical, and is very probably the tooth of the maxillary bone, near the position of the superior canine of a mammal.

It may be observed in conclusion, that if the teeth suspected by Leidy to be canines of *Aublysodon horridus*, but which I suppose to be incisors, are really such, *Aublysodon* must be regarded as a genus distinct from *Lælaps;* while, on the other hand, should such determination prove to be inadmissible, and the two genera be the same, the name *Lælaps* must be preserved as the older; it was published in 1866, while *Aublysodon* bears date 1868.

In examining the very numerous teeth discovered by the expedition, I find four species in addition to those already named. A list of all the species is now given.

Lælaps incrassatus, Cope, Proceed. Acad. Nat. Sci. 1876, Oct.

The dentary bone of this species, above alluded to, is of compressed form, and becomes thin and plate-like in its posterior portion. The latter is excavated on the inner side, where it is proba-

bly applied to the opercular and surangular bones, if they exist, and a large foramen is continued from the concavity into the remaining part of the dentary, as a tubular canal. Above the foramen there originates a groove which runs parallel to the inner alveolar border to the posterior edge of the symphysis. The latter is short, and scarcely distinguished from the other surfaces; the attachment of the rami was evidently ligamentous and more or less movable. The anterior alveolar portion of the ramus is produced, so that the symphysis slopes backwards below. The inferior border of the dentary bone is gently concave behind its middle. It is throughout convex in the transverse direction.

The external alveolar wall is an inch higher than the internal. The inner portions of the septa are apparently subject to exfoliation and subdivision in connection with the renewal of the teeth as a groove which is continuous with the inner alveolar borders, cuts them off from the other interior surface of the dentary bone. The external face of the dentary is in general plane, but is variously excavated along its superior border. An inch below the latter there extends a series of large foramina, each one of which is situated opposite to an interalveolar septum. They are more numerous anteriorly, a foramen being opposite each alveolus as well, and each foramen is connected with the border by a shallow groove. Similar foramina extend down the outer side of the symphyseal border, and along the inferior border of the dentary for two-thirds of its length. The same proportion of the external face is obsoletely rugose through the presence of delicate lines of growth. Such lines extend on the lower part of the interior face obliquely upwards and backwards.

There are alveolæ for fifteen teeth in the dentary bone. Of these only the second, third, fourth, fifth, twelfth, and fifteenth contained teeth capable of functional use at the time the jaw was inclosed in the lacustrine mud. Successional teeth occupy the first, tenth, and twelfth, but no two teeth are in an identical stage of protrusion. The section of the crown from and including the fourth to the last is nearly equilaterally lenticular. Their surface is smooth.

Measurements.	M.
Length of entire dentary bone	.525
Depth at posterior border of symphysis	.110
" " last tooth	.192
" to internal groove	.060
" " " foramen	.074
Length of crown of second tooth	.029
Diameter of second tooth at base { antero-posterior	.013
Diameter of second tooth at base { transverse	.018
Length of crown of twelfth tooth	.043
Diameter at base of twelfth tooth { antero-posterior	.025
Diameter at base of twelfth tooth { transverse	.017
Length of crown of superior ?canine	062
Antero-posterior diameter of do.	.028

As compared with the *Lælaps aquilunguis*, of which a portion of the dentary bone is known, this species differs in the greater diameter of its inferior border anteriorly, in the presence of the internal groove, in the greater elevation of the external alveolar wall, and, if the character be constant, in the greater robustness of the form of the dental crowns. The individual here described is rather larger than the type of *L. aquilunguis*, but it is probable that the species were not very different in dimensions.

Lælaps hazenianus, sp. nov.

Seven teeth from different localities present constant characters which readily distinguish them from all other species of the genus. Their size is less than those of the two species above mentioned, and is greater than in the species enumerated below.

The crowns are short and robust, and are abruptly terminated by the strong recurvature of the anterior cutting edge. The apex has, therefore, a more posterior direction than in the *L. incrassatus*, while the anterior cutting edge is shorter. The latter is shortened below also, not extending to the base of the enamel, but terminating in a short lateral curvature. At the base, therefore, the anterior border is rounded, while the posterior is acute. The denticulations are of medium size, measuring M. .00033.

Measurements.	M.
Length of crown	.014
Diameter of crown { antero-posterior	.011
Diameter of crown { transverse	.007

Both sides are convex, but not equally so, and the surface is smooth, and without facets.

This saurian is dedicated to General Hazen, now in command at Fort Buford, Dakota, as a token of respect for his qualities as a man and his services in the interest of science.

Lælaps lævifrons, sp. nov.

A tooth half the size of those referred to the *L. hazenianus*, and exceeding by a little the largest of those of *L. explanatus*, presents such characters as induce me to believe that it belongs to a species distinct from either. It is of the elongate acuminate form of some of those referred to the *L. incrassatus*, and both sides are convex, but not equally so. A shallowly concave plane occupies the middle of the more convex side. The posterior cutting edge is denticulate to the base, but the anterior, though of the same form as in the other species, and unworn, is absolutely smooth. In this respect it differs from the other species, excepting *L. falculus*. The denticulations are finer than those of any other species, measuring M. .00020; in *L. explanatus* they measure M. .00022.

Measurements.		M.
Elevation of crown		.015
Diameter of crown	antero-posterior	.007
	transverse	.004

Lælaps explanatus, Cope, Proceedings Academy, October, 1876.

Lælaps falculus, Cope, loc. cit.

Lælaps cristatus, Cope, sp. nov.

Another small species well distinguished by the form and coarse denticulation of the teeth, approaching the genus *Troödon*.

The crowns of the teeth are short, stout, compressed, and curved. Both sides are convex, and neither is facetted. The denticles are large, those of the posterior cutting edge the largest, and measuring M. .0005. A characteristic feature is the full development of the denticulate anterior cutting edge of the crown. This extends to the base, becoming more prominent as it descends. Surface smooth.

Measurements.		M.
Elevation of crown		.011
Diameter of crown	antero-posterior	.006
	transverse	.003

ZAPSALIS, Cope.

The teeth of this genus are intermediate in form between those of *Lælaps* and *Paronychodon*. They have one flat and one con-

vex side, whose junctions form the anterior and posterior edges of the crown, as in the latter genus; and like the latter, there is no anterior cutting edge, but instead, a solid angle. But the posterior edge is denticulate as in *Lælaps*, and the plicæ or keels of *Paronychodon* are here only recognizable in low angles. Some light may be cast on the affinities of the latter genus by the discovery of *Zapsalis*.

Zapsalis abradens, sp. nov.

This reptile was apparently about the size of the *Lælaps lævifrons*. The best preserved tooth is that of a probably adult animal, as it displays considerable attrition, especially on the flat side. Here three worn lines indicate the former existence of as many low longitudinal angles of the surface, of which the median is basal and short. The convex side exhibits four low angles of nearly equal length, all stopping short of the apex. The facets between them, excepting the anterior two, are slightly concave. The denticles are of moderate coarseness, measuring M. .00033.

Measurements.		M.
Elevation of crown		.0120
Diameter of crown	antero-posterior	.0065
	transverse	.0030

URONAUTES, Cope.

Genus novum Sauropterygiarum. Cervical vertebræ, like the dorsals and caudals, short and transverse, and distinct from each other. Neural arches and transverse processes coössified at maturity. Transverse processes of the cervicals simple and depressed. Extremities plesiosauroid.

This genus might be referred to *Polycotylus*, Cope, were it not for the distinctness and greater abbreviation of the cervical vertebræ. From *Cimoliasaurus*, Leidy, it differs in the coössification of the caudal diapophyses and the much greater abbreviation of the cervical vertebræ. The centra are amphiplatyan in *Cimoliasaurus*, biconcave in *Uronautes*. From *Pliosaurus*, Owen, which resembles the present form in the shortness of the cervical vertebræ, the coössified transverse processes of the cervicals separate it. The present is pre-eminently a short-necked genus of the order.

The remains on which it reposes are the cervical, dorsal, and caudal vertebræ, with portions of limb and rib bones.

Uronautes cetiformis, sp. nov.

The cervical vertebra of this species is of unusual form, being short and transverse, and not wider than deep. In *Polycotylus latipinnis* this vertebra is much wider than deep, and as long as wide. The neuropophyses are compressed so as to be antero-posterior, and they inclose a rather wide neural canal. The parapophyses are directed equally downwards and outwards, occupying the position of the angle of a subquadrate outline, since the sides are nearly vertical. The articular faces are slightly concave, and the centrum is perforated vertically by the usual two foramina.

A dorsal vertebra found in immediate proximity to the cervical just described is much like that of the *Polycotylus latipinnis*. That is, it is exceedingly short antero-posteriorly, and has concave articular faces, the concavity with flat fundus, and marked with a few obscure concentric grooves. The sides are also slightly concave, and are pierced with a foramen at the superior portion. The vertical foramina are also present. The neural arch is in this specimen separated from the centrum, not having become coössified. This circumstance might lead to a doubt as to the proper reference of the specimen to this animal, but such doubt has little foundation. In one of the caudal vertebræ one of the diapophyses is coössified, and the other is not. The suture of the surface thus exposed is of a very fine texture, and evidently not like that seen in the genera where it is to act as a permanent articulation. In the case of the dorsal vertebra, the suture for the neuropophysis has the same character. This vertebra is much larger than the cervical, but does not much exceed the proximal caudal in size; preserving the relations seen in the *Polycotylus latipinnis*. Adjoining the border of the fossa of the neuropophysis is a small parapophysial tuberosity.

A proximal caudal vertebra has a very small fore and aft diameter, and the vertical exceeds the transverse diameter. The diapophyses spring from the middle of the sides of the centrum, while the inferior face is separated from the inferior lateral faces by an obtuse longitudinal angle. In general, the form is that of a transverse hexagon. The chevron facets are very slightly developed. Another probably distal caudal vertebra considerably resembles that in the corresponding part of the skeleton of a cetacean. It is without neural arch, transverse, flat below, and

with the two lateral faces of unequal length, the superior being the longer. The vertical perforating foramina join at the neural canal, and there is a short subquadrate plane on each side of the latter. There are no indications of chevron facets. These vertebræ are different from any of those yet known in *Polycotylus*.

Measurements.		M.
Diameter of a cervical centrum	antero-posterior	.016
	vertical	.026
	transverse	.029
Diameter of a dorsal	antero-posterior	.030
	vertical	.055
	transverse	.056
Diameter of a proximal caudal	antero-posterior	.022
	vertical	.040
	transverse	.062
Diameter of a distal caudal	antero-posterior	.015
	vertical	.017
	transverse	.038
Diameter of neural canal of the proximal caudal above measured		.012
Do. of diapophysis of do. at base		.018

The distal end of a proximal limb bone is much like the corresponding part of *Polycotylus latipinnis*. It is relatively of large size, flat, and strongly convex at the extremity, which is not transversely truncate. A portion of another limb bone, perhaps belonging to the distal segment, is symmetrical. The shaft is broken off, and displays a large medullary cavity, with thin walls, which soon terminates towards the articular end, in a fundus with a fissure in the bottom. The proximal portion of a rib has a truncate head of an oval outline. The inferior border presents a low tuberosity, which may represent the capitulum.

Measurements.		M.
Width of distal end of proximal limb bone		.109
Thickness of the same		.032
Diameter of proximal end of a rib	longer	.030
	shorter	.028

The bones above described were found together by the writer, on a slope of the cream-colored soft sandstone, which lies above the black shales of Cretaceous No. 4, near Amell's Creek, Montana. I suppose the formation to be the No. 5, or Fox Hills group of Meek and Hayden. Near them were found shark's teeth

of the genera *Otodus* and *Lamna*, and a species of *Enchodus*. Above them I found lying loose a fragment of a *Baculites*.

CHAMPSOSAURUS, Cope.

Genus novum. Vertebræ of more than a hundred individuals referable to several species, which I obtained from the Judith River beds of the Upper Missouri region, present characters which demand the establishment of a new genus for their reception.

The characters presented by the vertebral column are the following: The ribs have a single head, which articulates with a prominent tuberculum, excepting those of the cervical vertebræ. On these there is a small capitular tubercle below the diapophysis. It commences very small, and inferior in position, being removed, in fact, but a short distance from the inferior middle line in the first vertebra in which it appears. It rises rapidly in the succeeding centra until it is merged in the tuberculum of the diapophysis. The latter projects from the neural arch, which is free from the centrum, but in none does the base of the diapophysis rise from a point above the floor of the neural canal. On the dorsals it is vertically compressed. One of the anterior cervicals, probably the axis, is obliquely truncated below its anterior articular face, for a free hypopophysis or *os odontoideum*. This vertebra has no parapophysis, and the articular faces for the neuropophysis are superior. The few vertebræ in each of several series, probably from the sacral region, are more depressed than the others, and the facets for the diapophyses present a greater antero-posterior extent, but none are coössified. The caudal vertebræ are distally quite compressed. In all, except the anterior ones, the neural arch is coössified with the centrum, and in such there are no diapophyses. In those with free neural arch, the facets for the neuropophyses turn down on the sides of the centrum.

The articular extremities of the centra are plane, those of the caudal series slightly concave. There are no hypapophyses behind the axis, excepting a longitudinal carina, which ceases to exist on the dorsal vertebræ. The zygapophyses are simple. The chevron bones are free.

The relations of the atlas and axis, though not fully elucidated by my specimens, are peculiar. The former has separate neurapophyses, which have nearly the shape of those of the Streptostylicate *Reptilia*, resembling much those of the *Pythonomorpha*.

Although I procured numerous cervical vertebræ, there are but few which exhibit the antero-inferior facet for supposed hypapophysis, already described. The position of this vertebra was in front of the first cervical which displays a parapophysis, and is, on this account, likely to be the axis or the third cervical vertebra. It is the more probably the axis, as there is no other among the large number of vertebræ in my collection which can be referred to that position. Its anterior articular face is smooth and like the posterior, showing that the odontoid bone was not coössified with it. Now in the *Crocodilia* the odontoid bone is united with the anterior extremity of the axis by suture, which may become coössified with age, while the free hypapophysis is wanting. In the streptostylicate orders the hypapophysis is present, and the odontoid is above it, but united to the axis by suture. On the other hand, in the *Rhynchocephalia*, the axis is coössified with both odontoid and hypapophysis, and a few succeeding vertebræ possess free hypapophyses. Thus it is possible that I am yet unacquainted with the axis of *Champsosaurus*.

One entire rib and the heads of several others are all that were obtained. The former is from the anterior part of the dorsal series, and is stout and short. The head is truncate and compressed, its articular face is contracted, forming a narrow figure eight. The shaft is obliquely flattened. The extremities are separated from the lateral surfaces by a narrow angle, as though capped with cartilage in life, as in the *Pythonomorpha*.

Bones of the extremities are very rare. One fragment resembles the proximal end of a crocodilian tibia, and another is like the distal half or more of the tibia of the same type.

There is considerable resemblance between the vertebræ of this genus and those of *Hyposaurus*, Ow., from Cretaceous No. 5, of New Jersey, but the relations of the axis and atlas in that genus are as in other *Crocodilia*, and not like those seen in *Champsosaurus*. The absence of sacrum precludes the possibility of regarding this form as dinosaurian. It rather seems to share some rhynchocephalian characters with general amphiplatyan crocodilian resemblances. The shortness and robustness of the thoracic ribs is a feature quite unique, and reminds one of the *Batrachia*. The teeth are unknown in their true relations, but there are several types in the collections which may be found to belong here. These are of the rhizodont character.

As a summary of the preceding, I propose to refer the genus *Champsosaurus* to the order *Rhynchocephalia*, provisionally. It differs very much from the typical genus of that order, *Sphenodon*, in the non-coössification of the sacral vertebræ, and non-union of the neural arches of the vertebræ with their centra, and the absence of the chordal perforation of the latter. It differs from the extinct genera *Clepsydrops* and *Cricotus*, Cope, in the last mentioned two characters. On these grounds it may constitute a distinct suborder, under the name of *Choristodera*.

It is possible that the tooth, which I referred to a new genus and species, under the name of *Paronychodon lacustris* (Proceedings Academy, 1876, October), may belong to one of those of the present genus. In that case the older generic name takes precedence of the later. I may add that some vertebræ of this genus have been figured and described by Dr. Leidy in the Transactions of the American Philos. Society, 1860, without name.

I recognize four species among the vertebræ, chiefly by characters observed in the cervical region. There is a great discrepancy of size among them, and the small ones may be immature.

Champsosaurus profundus, sp. nov.

This species is chiefly known from a series of vertebræ found together, and having every appearance of pertaining to the same animal. It consists of a cervical, three dorsal, and a sacral vertebræ. Other isolated vertebræ of several individuals present similar characters.

The primary feature is the great vertical diameter of the dorsal vertebræ as compared with the transverse measurement. This is occasioned by the great development of the inferior keel, to which the sides of the centrum converge, without concavity. In corresponding centra of the *C. annectens* the inferior face is merely angulate. Another character is the obliquity of the articular faces to a vertical plane drawn at right angles to the long axis of the centrum. This is most strongly marked on posterior dorsals, where the inferior keel is less prominent. The sacral vertebra has a depressed form.

An anterior caudal vertebra may belong to this or an undescribed species. It has rudiments only of the chevron-facets, and having a large neural arch, is doubtless from the anterior part of the series. It is more compressed than the corresponding one in *C.*

annectens, and has an acute inferior angle, which is wanting in the latter.

Measurements.

		M.
	No. 1.	
Diameter of cervical centrum	longitudinal	.020
	vertical	.020
	transverse	.018
Diameter of anterior dorsal centrum	antero-posterior	.020
	vertical	.022
	transverse	.019
	No. 2.	
Diameter of posterior dorsal centrum	antero-posterior	.023
	vertical	.019
	transverse	.019

Champsosaurus annectens, Cope, sp. nov.

The greater number of vertebræ obtained belong to this saurian, which may therefore be looked upon as the type of the genus.

The cervical which bears the hypapophysial facet presents a carina below, which is only prominent between the articular faces. One such cervical in the collection is rounded below, and may be anterior in the series, or may belong to another species. The inferior keel is strong on the other cervicals, but soon disappears on the anterior dorsals. The remaining centra are rounded below. The parapophyses where present are knob-like, and the corresponding part of the transverse process is similar in the anterior dorsal vertebræ. The base of the neural arch is nearer the anterior than the posterior articular face. These faces are nearly round in the anterior caudal centra, but soon become vertical ovals, with the compressed form. There is a fossa below and in front of the parapophysis, which continues to beyond the anterior dorsals. The dense layer of the surface of the centrum is smooth, except some delicate striations near the articular borders. These are most marked along the median inferior face of the caudal vertebræ, which is flat, grooved, and distally acute.

I cannot certainly connect the vertebræ of a series as those of a single individual.

Measurements.

		M.
	No. 1.	
Diameter of a cervical with hypapophysis	antero-posterior	.023
	vertical	.021
	transverse	.020

		M.
	No. 2.	
Diameter do. without hypapophysis	antero-posterior	.017
	vertical	.0165
	transverse	.017
	No. 3.	
Diameter do. without hypapophysis	antero-posterior	.011
	vertical	.0105
	transverse	.011
	No. 4.	
Diameter of an anterior dorsal	antero-posterior	.023
	vertical	.023
	transverse	.023
	No. 5.	
Diameter of an anterior dorsal	antero-posterior	.008
	vertical	.0072
	transverse	.0075
	No. 6.	
Diameter of a sacral centrum	antero-posterior	.010
	vertical	.009
	transverse	.009
	No. 7.	
Diameter of an anterior caudal	antero-posterior	.083
	vertical	.053
	transverse	.058
	No. 8.	
Diameter of a median caudal	antero-posterior	.017
	vertical	.011
	transverse	.011
	No. 9.	
Diameter of a posterior caudal	antero-posterior	.014
	vertical	.0086
	transverse	.007

A vertebra not distinguishable from the corresponding one of this species was found near Amell's Creek, on a bank of deposit of the Fox Hills group (No. 5), with the bones of the *Uronautes cetiformis*, supra. I cannot account for this circumstance, as it is the most abundant fossil of the Judith River beds (No. 6).

Champsosaurus brevicollis, sp. nov.

On one occasion the writer discovered a number of vertebræ of this genus close together, and in such relation as to induce the belief that some of them belonged to the same individual. Parts of several were obtained, however, adding another evidence of the

manner in which the fossils of this formation have been dislocated and scattered. The evidence for the existence of this species must be allowed to rest at present on a cervical vertebra, with free hypapophysis. This body differs from the corresponding one in the *C. annectens* in its greater brevity as compared with its length. The vertical and transverse diameters exceed the longitudinal in the *C. brevicollis*, while in the *C. annectens* the length exceeds both. The inferior aspect of this centrum is broadly rounded, not carinate as in *C. annectens*. The value of this character is uncertain, but a centrum similarly rounded below (above alluded to) has the more elongate form of the *C. annectens*.

Measurements.		M.
Diameter of centrum	antero-posterior	.013
	vertical	.014
	transverse	.015

Champsosaurus vaseianulensis, sp. nov.

This reptile is indicated by a posterior dorsal vertebra in which the common base of the neural arch and diapophysis is decurved to below the middle of the side of the centrum. This surface has somewhat the outline of the section of a T-rail, the inner portion being on the superior face of the centrum. The centrum is shorter than the corresponding ones of the *C. annectens* and *C. profundus*, so that the basis of the neural arch approaches near the borders of the articular faces above. The centrum is perforated by two vertical foramina as in most *Sauropterygia*. The osseous tissue of the body is quite dense, and the surface is smooth.

Measurements.		M.
Diameter of centrum	antero-posterior	.026
	vertical	.029
	transverse	.045

Besides the much larger size, this species differs from those previously referred to this genus in almost all details of proportion, etc.

SCAPHERPETON, Cope.

Genus rarum Batrachiarum. Vertebræ deeply biconcave, with opposed, but not continuous, foramina for the chorda dorsalis. Neural arch with zygapophyses, and well-developed neural spine. Centrum with vertically compressed, short diapophysis

near the posterior extremity, a prominent hypapophysial keel, and prolonged neural spine. Supposed proximal limb bone with a branch-like trochanter. Supposed teeth in several rows, attached in shallow alveoli, those of the marginal series larger; the crowns obtusely conic and simple.

In the above diagnosis are expressed the general characters of a genus of probably tailed *Batrachia* which has left remains of several species in the Judith River beds of the Upper Missouri region. Although the vertebræ resemble no little those of *clepsydrops*, Cope, a rhynchocephalian lizard from supposed triassic or permian formations, the atlas is that of a batrachian. The limb bone probably belonging to it, is unlike that of any genus of the *Proteida* or *Trachystomata*, differing also from that of *Menopoma*, but approaching nearly that of the typical salamanders. The diapophyses are different in form from those of the *Trachystomata Proteida* and *Amphiumidæ*, but resemble in their vertical compression those of *Menopoma*. They are generally broken in the specimens, but where preserved, are much shorter than in that genus, being even less produced than in most of the recent salamanders. The prominent keel of the median line below is not found in salamanders, and it has no posterior prolongation resembling the structure seen in *Amphiuma* and *Cæciliidæ*. The produced neural spine is a character not found among tailed *Batrachia*, and the posterior direction which it takes reminds one of the *Dinosauria* more than anything else, and is not like the form seen in *Lacertilia*. It is a prolongation of the roof-like extension of the neural arch seen in some of the tertiary salamanders of France.

The structure of the proximal limb bone, and the form of the diapophyses of the vertebræ refer this genus with much probability to the *Urodela*. The produced neural arch, and the probably complex disposition of the teeth, indicate a family different from any of those now living. The biconcave centra place it nearest to the *Amblystomidæ*.

The teeth above mentioned are attached to a fragment of a jaw-bone. The crowns are all imperfect, and mostly broken off. There are three series of smaller teeth and a marginal series of teeth of one [illegible] greater diameter. They exhibit a moderate pulp cavity, and [illegible] treatment of the crowns is not inflected. It has a [illegible] dity, and the bases of the teeth are rugose

with impressed punctæ. The teeth are described here because it is not known to which species they belong. It is, indeed, not certain, but only probable, that they belong to this genus.

Four atlases preserved indicate two species; one being more depressed than the other three, and the anterior cotyli therefore more transverse.

The vertebræ indicate four species. It is probable that they present some pecularities at different points in the same column, the caudals at least differing in some degree from the others. The characters of the species are quite well marked.

Saphæopeton tectum, sp. nov.

Represented by a vertebra which is one of the best preserved in the collection. The most prominent specific character is seen in the entire roofing over of the neural canal between the anterior zygapophyses, and in the downward production of the inferior median line of the centrum, and accompanying downward prolongation of the articular cups. The chordal perforation is at the superior fourth of the vertical diameter of the cups. The neural spine is produced backwards and curved upwards, and is narrowed between the posterior zygapophyses, and is striate grooved on the under surface. About half of the posterior zygapophysis projects beyond the edge of the cup of the centrum. Immediately below the anterior edge of the posterior zygapophysis, the diapophysis begins. It is vertical, of an irregular figure 8 in section, and is directed outwards and backwards. A foramen passes under its middle, emerging a little before the middle of the same horizontal diameter of the centrum. It is joined by another which strikes it from below at right angles. There is a deep notch embraced between the superior part of the diapophysis and the posterior zygapophysis. The neural canal is wider than deep.

A fragment accompanied this vertebra when found, which resembles the articular portion of the mandible. There is no angle projecting behind the quadrate facet, which is oblique, truncating the extremity of the ramus. The lower edge is acute, behind roughened, and a thickening extends along the middle of the inner side of the ramus so far as preserved. The character is that of a Urodele Batrachian.

Measurements.		M.
Diameter of centrum	antero-posterior	.0875
	vertical	.0750
	transverse	.0500
Vertical diameter of diapophyses		.0500
Transverse diameter of neural spine between posterior zygapophyses		.0500
Depth mandibular ramus at front of quadrate cotylus		.0800

Scapherpeton laticolle, sp. nov.

Vertebræ of several individuals of smaller size than those referred to the *S. tectum* differ in the less extensive development of the roof connecting the anterior zygapophyses, and the greater compression of the centrum, in consequence of the downward production of the inferior keel. The neural arch is openly notched between the anterior zygapophyses, but the notch is bounded by a recurved lamina distinct from the zygapophyses. The diapophyses are much as in *S. tectum;* the ridge from the inferior portion of it is quite prominent, and includes with the base of the neural arch a deep fossa.

Accompanying a dorsal vertebra like those of this species, and probably belonging to the same skeleton, is an atlas of a more depressed form than those presumably belonging to the other species. The median tuberosity is well developed, constricted at the base, and much flattened. The condyloid facets are narrow and transverse.

Measurements.		M.
Diameter of dorsal centrum	antero-posterior	.070
	vertical	.050
	transverse	.030
Width of the neural canal		.020
Vertical diameter of base of diapophysis		030

If it should appear that the dorsal vertebræ do not represent species distinct from the *S. tectum*, the *S. laticolle* may rest the atlas described.

The limb bone above mentioned is associated with the neural arch of a vertebra of the character ascribed to this species. Both extremities are eroded so as not to display the forms of the condyles, though almost the entire length is preserved. The trochanter is imperfect, but its base is that of a subcylindric process. The head of the bone is subtriangular, and the section

distal end an oval with a flat side. The diameter contracts gradually to the middle.

Measurements.		M.
Length of bone		.0150
Diameter	proximally	.0036
	medially	.0019
	distally	.0037

This bone is plainly that of a urodele salamander.

Scapherpeton excisum, sp. nov.

This salamander is represented in the collection of the expedition by vertebræ of three individuals of different sizes. They all agree in having the anterior zygapophyses separated by the concave excavation of the roof of the neural canal usual in ordinary salamanders, and in the moderate development of the hypapophysial keel. As a result, the articular extremities of the centra are not produced so far inferiorly as in *S. laticolle*. The longitudinal ridge from the inferior part of the diapophysis is pronounced, and separates a deep fossa above it from another below it. The longitudinal perforation of the base of the diapophysis issues in the superior fossa, while in the two smaller specimens a vertical perforation joins it from the inferior fossa. As in the preceding two species, one articular face is a little deeper than the other.

Measurements.		M.
Diameter centrum No. 1	longitudinal	.009
	vertical	.006
	transverse	.005
Width of neural canal do.		.003
Depth " "		.0015
Diameter centrum No. 2	longitudinal	.0060
	vertical	.0033
	transverse	.0030

Specimen No. 1 is as large as the corresponding portion of an *Amphiuma means*.

Scapherpeton favosum, sp. nov.

The vertebra which I select as typical of this species is more distinct in character from those of the three species above described, than they are from each other. Although the centrum [illegible]s a strong inferior keel, its border is not horizontal or con[illegible]ave, and the articular cups are proportionally little [illegible]rds. The diapophyses have at their bases a

relatively small vertical diameter, and the longitudinal perforation enters below and before the base and not behind it. The longitudinal ridge from the inferior part of the latter is very prominent and horizontal, bridging over the vertical perforation, which enters the superior lateral fossa. It is separated below from the posterior perforation by a short oblique bridge. The neural arch is lost from this specimen.

There are other vertebræ which display a slightly developed inferior keel, and articular cups little produced downwards, but the fossæ are less developed than in the one described.

Measurements.		M.
Diameter of centrum	antero-posterior	.006
	vertical	.004
	transverse	.003

The typical individual was about as large as the *Menopoma*.

HEMITRYPUS, Cope.

Represented by a vertebra of the general character of those of the genus *Scapherpeton*, but which lacks the foramen chordæ dorsalis of the posterior half of the centrum, and is not carinate on the inferior surface. The diapophysis is directed backwards just below the posterior zygapophysis, inclosing with it a notch into which the anterior zygapophysis is received. Anterior zygapophyses connected by a prolongation of the neural arch.

I had suspected that this vertebra might be one of those of the cervical region of a species of *Scapherpeton*, but the position of the foramen chordæ dorsalis renders this highly improbable. The only position to which it could be assigned in the column of this genus would be that of the axis. But the foramen is present in the posterior half of the atlas and thus probably in the axis in *Scapherpeton*, as in vertebræ from all other regions of the column, so that such an exception as is presented by the present centrum is not to be looked for. The absence of the carina, and the cylindric form of the centrum, add to the belief that the species does not belong to *Scapherpeton*.

Hemitrypus jordanianus, Cope, sp. nov.

No emargination between the anterior zygapophyses; neural spine directed upwards and backwards. The diapophyses vertically compressed, directed downwards, inwards, and backwards,

and not giving origin to a strong ridge on the side of the centrum, as is seen in the species of *Scapherpeton*. Neither is there any fossa on the side of the centrum as in that genus. There is a small longitudinal foramen which enters the inner base of the inferior half of the diapophysis. There is a low ridge on each side of the neural arch, which extends backwards and inwards. The anterior articular face is a wide oval somewhat contracted below, and is pierced by a foramen at a point within the superior third of the vertical diameter. It is not so deeply excavated as in the species of *Scapherpeton*. The posterior articular face is a regular vertical oval, is concave, but not excavated, as is seen in the centra of the genus just mentioned. The inferior face of the centrum is rounded, with some feeble lateral ridges.

Measurements.		M.
Diameter of centrum	longitudinal	.0070
	vertical	.0050
	transverse	.0040
Total elevation at middle		.0090
Expanse of posterior zygapophyses		.0070
" " "	diapophyses	.0095

About the size of the *Menopoma alleghenense*.

This batrachian is dedicated to Prof. D. S. Jordan, of the Northwestern Christian University, author of the Manual of the *Vertebrata* of the Eastern United States.

OUR SIDEREAL SYSTEM, AND THE DIRECTION AND DISTANCE TO ITS CENTRE.

BY JACOB ENNIS.

I. THE FORM OF OUR SIDEREAL SYSTEM.—Before we can find the centre of an object, we must have a knowledge of its form. The form of our system is determined by the ring of the galaxy; because it is computed to contain eighteen millions of stars, while all the other stars situated around and within that ring are supposed to number only about two millions. The best observers declare that they can look fairly through the galaxy, and see beyond only the black ground of empty space. Its ring form is further proved by the fact that the great mass of its stars are of the same small magnitudes, from the 9th to the 12th. If it were merely the appearance of a *stratum* of stars extending outward from our own vicinity, it would contain many more stars of large magnitudes, and these magnitudes would regularly and gradually decrease in size from their increasing distances. But no such appearance is presented. Therefore, as Sir John Herschel announces, "it is not a *stratum*, but an *annulus*."

In the general direction of the galaxy, though situated far beyond, there are very many easily resolvable nebulæ, which are unique among all nebulæ, from their very irregular forms and aspects. From their appearances and positions, and resolvability, they must be members of our own sideral system, and they occupy the same relative position to the galaxy, as the systems of Jupiter, Saturn, and Uranus hold to the ring of the asteroids.

In some places observers cannot apparently see through the galaxy; stars, or rather nebulæ, appear beyond one another indefinitely. These appearances are explained by the resolvable nebulæ just mentioned, which are the extremely distant members of our system, and by the irresolvable nebulæ in the same direction, though far beyond, which are independent sidereal systems. The two seem to make a continuity of stars. Mere vision in such cases fails to distinguish these distant sidereal systems from the outlying members of our own system; the same as Saturn and Sirius when side by side, seen by mere vision, seem to be equally distant. Irresolvability is at present a decisive test between the

outlyers of our own system, and other independent sidereal systems.

That our sidereal system has definite bounds, we may believe from the definite boundaries of other distant sidereal systems. Often they are regularly round or elliptical; and even those with irregular contours may have their stars to revolve in nearly circular orbits; the same as our solar system must appear to distant observers to be extremely irregular in contour, although its revolutions are nearly circular.

Neither is our opinion of the definite boundary of our system disturbed by the appearance of new stars with every new power added to the telescope. These newly-discovered stars may be its smaller members, and comparatively near, and visible only by high powers.

Nor is it an argument against the ring form of the galaxy, because it is broken by a slight transverse rift in the southern hemisphere. My recollections are distinct that this rift is exceedingly narrow, hardly observable, and smaller by far than the longitudinal rifts in both hemispheres.

Therefore all objections are easily answered, and we have solid grounds to conclude that our sidereal system is round, and in the main, disk-like in form, with the vast majority of its stars in or near the plane of the galaxy. The ring form of the chief mass of our system, is confirmed by the existence of other rings of stars, as the annular nebulæ, the ring of the asteroids, and the rings of Saturn, composed, there is good reason to believe, of very little stars, the majority not larger than meteorites.

II. The Position of the Centre of Gravity.—From the form of our sidereal system the conclusion is clear and irresistible that the centre of gravity of the system must lie in the plane of the galaxy. It is also equally clear that this centre must be situated in the centre of that plane. Because the stars in general are equally numerous, and equally large and bright in all extended regions of that ring. They appear a little brighter towards the southern pole; but this seems an indication that our own position is a little nearer that side of the galactic ring.

III. All the Stars of our Sidereal System Revolve with high Velocities around its Centre of Gravity.—It was formerly supposed that the vast distances between the stars cut off this intergravitating force. Newton, in his Principia, uses this

language: "The fixed stars, therefore, being at such vast distances from one another, can neither attract each other sensibly, nor be attracted by our sun." This opinion was generally held among his followers, one of whom has remarked: "So remote are the nearest of the fixed stars, that it may be doubted whether the sun has any sensible influence on them." It is remarkable that the thought occurred to no astronomer to calculate the force of gravity from our sun on the fixed stars, until more than a quarter of a century after the distances of some of these stars had been approximately discovered. Then this was first done by myself, and the amount of this force was found to be surprisingly large. To present an impressive and graphic view of that amount, I brought it out in terms of the velocity around our sun required for gaining a centrifugal force so great as to prevent a revolving body from falling in the sun. I employed two methods of demonstration quite independent of each other, and by both the same results were obtained. As these methods have already been stated in the "Origin of the Stars," they need not be repeated here. By them it was proved that our sun acts so powerfully on Alpha Centauri that, if there were no other influence, Alpha Centauri would have to revolve around our sun at the rate of 145 miles an hour to gain a counterbalancing centrifugal force. That star, judging from its distance, and its amount of light, must be two and a third times greater than our sun. Therefore its power of gravity alone on our sun is such that, without any other influence, our sun must revolve around it at the rate of 222 miles an hour to gain a counterbalancing centrifugal force. Judging from its distance and its light, Sirius is at least sixty times greater than our sun. Therefore our sun would have to revolve around Sirius at the rate of 580 miles an hour to avoid falling into its flames. In all these instances, the gravity of a single star has alone been calculated, and not the combined force of the two.

These velocities impress strongly on our minds the greatness of the force of gravity between the stars of our sidereal system. How inconceivably mighty must be the united force between the twenty millions of stars. How strongly must they all be impelled toward this common centre of gravity. And how swift must be their velocities around that centre to gain a centrifugal equal to the centripetal force. Now, first, we understand the necessity of such high velocities as those of 61 Cygni, and of

Arcturus, and of other stars; that is, velocities from nearly 2000 to nearly 3000 miles per minute, velocities about double any of those seen among the planets of our solar system.

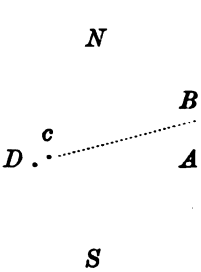
It is evident that the stars of the galaxy must all move in the same direction around in the plane of the galactic ring, otherwise they would fly off, and soon there would remain no ring.

It is also evident that such rings of stars revolving with high velocities, both in our own and in other sidereal systems—annular nebulæ—coincide perfectly with the nebular theory which teaches the absolute necessity of ring formations abandoned by centrifugal force in high velocities of revolution.

IV. THE DIRECTION FROM OUR OWN POSITION TO THE GALACTIC CENTRE or to the CENTRE OF GRAVITY OF OUR SIDEREAL SYSTEM.—Our own position is certainly on the north side of the galactic plane; that is, on the same side with Ursa Major, and not on the side on which Orion appears. The median line of the galaxy, or its plane, does not coincide with a parallel great circle. Between the two, as projected on the heavens, there is a distance of about 2°, the precise distance being not yet determined within half a degree, more or less. This appears as follows: The median line of the galaxy is distant about 32° from the north pole; but on the opposite side of the heavens it is distant from the south pole only about 27°. Other measurements in other regions, not polar, correspond. This difference of five degrees must be equally divided, and there remains about 2½° as the distance in arc between the median line of the galaxy and a parallel great circle. Our own position therefore is situated, as measured by our great circle, about 2½° away from the galactic plane, and on its north side. We are further confirmed in this conclusion because it explains the fact that more stars are seen in the southern galactic hemisphere than in the northern. Many of these southern stars are really on the north side of the galactic plane, but being ourselves so much further north, they are projected on the southern galactic hemisphere. At first view this seems unlikely, but forthcoming proofs are convincing.

Now, being on the north side of the galactic plane, and if we were equally distant all around from the galactic ring, then the conclusion would be certain that the direction of the centre of the galactic plane, or the centre of gravity of our system, would be precisely *toward the south galactic pole*, that is, at about 119°

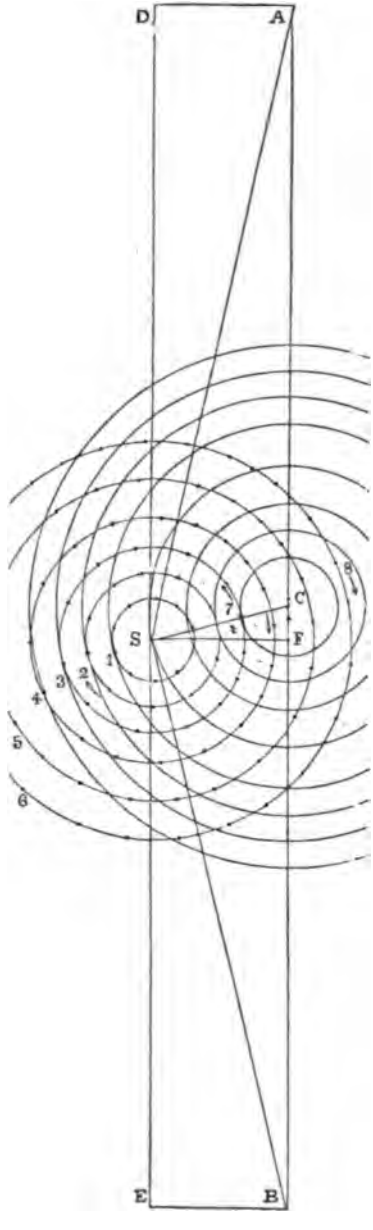
N, P, D, and a little east of the equinoctial colure. In such case there could be no other decision. But because the galactic ring appears a little brighter in the southern regions, it seems probable that we are situated a little nearer towards the southern side of that ring; consequently the galactic centre must be projected on the heavens a little to the north—the geographic north—of the south galactic pole, say in the tail of the constellation Cetus. This northern projection of the galactic centre may be illustrated as follows: Let N be a point in the geographic northern side of the galaxy, S the opposite point in the southern side, A the south galactic pole, and the dot at c the centre of the galactic plane or centre of our system. Then our position at D being a little nearer the southern side of the ring at S, the centre c would be projected on the heavens at B, that is, geographically north from the south galactic pole A. In the figure there is an exaggeration in the position of B to render the principle plain.



Therefore we may affirm, without pretending to absolute precision, that the DIRECTION of the centre of our sidereal system, and consequently its centre of gravity, must lie a little east of the equinoctial colure, and a few degrees north geographically of the south galactic pole; that is, in the tail of the constellation Cetus. It remains now to demonstrate—

V. THE DISTANCE FROM OUR OWN POSITION TO THE GALACTIC CENTRE, OR CENTRE OF GRAVITY OF OUR SIDERAL SYSTEM.—To find this we have the following data: First, that the median line, or plane of the galaxy, is distant from a parallel great circle $2\frac{1}{2}^{\circ}$; second, that the distance of the galactic ring from our own position is such as to require 2000 years for its light to reach us. This latter is Sir John Herschel's estimate of its nearest stars of the 9th magnitude. Struve computes that light requires 3400 years to reach us from the galactic stars of the 12th magnitude. In this demonstration the 9th magnitude galactic stars, with the distance for light travel of 2000 years, will be taken. In the figure S represents the position of our sun or our own position. The dotted circles are the distances of the stars of the several numbered magnitudes. A B is the plane of the galaxy, and C its centre. D E is the plane of a parallel great circle. S C is the

distance from ourselves to the galactic centre, or the centre of our sidereal system. *S F* is a line perpendicular to the galactic plane. Our position *S* is made a little nearer to the geographical southern side of the galaxy at *B*, for the reason already stated. *D A* is the arc, and *D S A* the angle between the galactic plane and a parallel great circle, at present assumed at $2\frac{1}{2}^{\circ}$. *S A F* = *D S A*. Light requires 2000 years to travel from *A* to *S*, or from *A* to *F* nearly. Here we have a right-angled triangle with three known elements, namely, *A F* = 2000; *S A F* = $2\frac{1}{2}^{\circ}$; *S F A* = 90°. From these elements it follows from the most simple of all trigonometrical processes that *S F* equals 87. Therefore it requires light 87 years to pass between ourselves and the plane of the galaxy, or about the same to reach the galactic centre at *C*. But according to the estimates of astronomers, light requires 85 years to reach us from the stars of the 5th magnitude; therefore the centre of our sidereal system is distant from our own position about as far as the stars of the 5th magnitude.



But the amount of the arc *D A* or the angle *S A F* is not yet precisely determined. If it be only 2°, then the distance from the galaxy is such

that light from there requires 70 years to reach us, and it must lie beyond the stars of the 4th magnitude, as it is drawn in the accompanying figure. If the angle *S A F* equals 1½°, then the light from the region of the galactic plane requires 52 years to reach us, and that plane must lie beyond the stars of the 3d magnitude. And so on, after the following table, where the third column expresses the number of years required for light to reach us from the stars of the several magnitudes, according to Struve, aud also from the galactic plane, when the first column expresses the different values of the arc *D A* or the angle *S A F*.

Angle S A F.	Star magnitudes.	Distances in years.
	1	15
½°		17
	2	28
1 °		35
	3	43
1½°		52
	4	61
2 °		70
	5	85
2½°		87
3 °		104
	6	120
4 °		140

We have now discovered approximately both the DIRECTION and the DISTANCE to the centre of our sidereal system. I need not at this early day be precise in my statements of either of these elements: these will require the careful observations and measurements of many years. When Copernicus had announced the centre of our solar system, his discovery was not vitiated nor rendered the less valuable because he made such an enormous error about the distance of that centre. Even yet, after the studies of 10 generations, that is, of 333 years, astronomers are still endeavoring to find more nearly the distance to the centre of our solar system. These round numbers just named measure the long flight of time which has intervened between the discoveries of these two centres, the centre of our solar and the centre of our sidereal system. In attaining precision in the distance to the centre of our sidereal system, the first element to be determined is the arc *D A*, or the angle *S A F*. Its nearest value seems to me at present to be 2°,

and the figure is drawn on that supposition, locating the sidereal centre between the stars of the 4th and 5th magnitudes.

In addition to the data contained in the five sections already given, our present determination of the direction and distance is confirmed by the observed movements of the stars. Hitherto, the proper motions of the stars, amounting to nearly 2000, have presented the most wild and disorderly confusion. Nothing can be more hopeless and forbidding than an attempt to find our sidereal centre from the study of these motions. But our present determination of that centre shows the causes of this apparent confusion. It is because we are situated on one side of our system, far outwardly and away from the centre, with some stars interior and other exterior to us; precisely the same reason why the motions of the planets seemed so tangled before the discovery of the centre of our solar system. I will here point out the operations of this cause in detail, along with other causes of this apparent disorder.

1. In our figure the two stars within the dotted circles, marked with arrows at 2 and 7, move in the direction of the arrows. On the face of the heavens, or on a celestial globe, they seem to move around in contrary directions, the same as they seem to move in our figure in contrary directions around our position at *S*. But in reality they both move in the same direction around our sidereal centre at *C*.

2. The stars at 7 and 8, marked with arrows, seem, from our position at *S*, to move in contrary directions, but in truth they both move in the same direction around the sidereal centre at *C*.

3. Our sun's motion must give apparent motions to many stars, and some of these may be contrary to their real motions, the same as our earth gives retrograde motions to the planets. To separate these apparent from their real motions will be a task of many years, even after we learn the true direction of the sun's motion.

4. As our sun is on the north side of the galactic plane, and nearly equidistant from the galactic ring all around, it follows that the plane of his orbit is nearly, perhaps quite, at right angles to the galactic plane. It is evident also that thousands of other stars move in planes either at right angles, or highly inclined, to the galactic plane. Hitherto all this has been a source of perplexity, but now we may begin to lay down the lines of their nodes

on the galactic plane, and make real progress in sidereal astronomy, evolving beautiful order out of this apparent confusion.

5. In a system like our solar system, with a large central orb, and all the stars nearly in the same plane, it is generally conceded that the revolutions of these stars must be around in the same direction; contrary motions being incompatible with stability. But this cannot be affirmed of our sidereal system, which has no large central and controlling orb, where the stars are very far apart, and where their orbits are highly inclined in opposite directions, nearly or quite at right angles to the galactic plane, and so have come to move in opposite directions around the sidereal centre. This has occurred to thousands of stars in our sidereal system. It has occurred also in other far distant sidereal systems, for they are globular in shape. If only a few appeared round we might suppose them discoid, with the planes of their disks perpendicular to their lines of sight. But such large numbers of round systems argue globularity of form.

6. My discovery of the intergravitation among the members of our sidereal system, as stated in Section III. of this paper, aids to prove that collisions must be impossible, or very rare between the members of our system, even when they move in opposite directions. When two stars are meeting from opposite directions, they are under the influence through gravity of all the neighboring stars, drawing them from the line toward each other's centres of gravity, and therefore the chances are infinite against their moving towards each other's centres of gravity. They must approach each other, not directly, but obliquely; they may pass so near to each other as to remain forever under the power of their mutual gravitation, revolving around their common centre of gravity, and becoming a double star. Hence, the wonderful spectacle in the heavens of ten thousand double and multiple stars, with many more still to be discovered. A pair of stars may attract a third, and a fourth, and indeed a larger group like the Pleiades and Coma Berenicis, and the clusters in Hercules. A considerable cluster by their united gravity might draw to themselves all or nearly all the neighboring stars, leaving nearly vacant spaces around the clusters. Whenever Sir William Herschel, in his sweeps of the heavens, came upon one of these vacant spaces poorly furnished with stars, he was sure to look out for a cluster, or nebulous looking mass, consisting of the stars collected to-

gether from the nearly vacant spaces. We know that binary systems of stars may have proper motions, and so may larger groups.

7. In constellations like Ursa Major, and Cassiopeia, and others, the motions of their individual stars around the centre of gravity of the constellation, may obscure or hide their motions around the centre of our sidereal system. The revolutions of the satellites of Jupiter and Saturn and Uranus have more rapid velocities around their primaries than the velocities of those planets around the sun. A like state of things, though not so extreme, may exist in a constellation. According to Struve and others, the distance of second magnitude stars is such as to require their light 28 years to reach us. If in a triangle we take this number for each of the two sides, and for the included angle the divergence between two adjacent stars in Ursa Major, we are surprised on computing the third side of our triangle, to find how near those stars must be together. Therefore knowing the gravitation of our sun on our neighboring stars, we must conclude that in a cluster like Ursa Major, the revolutions around its centre may greatly modify and perhaps reverse for a time, the proper motions of those stars around the centre of our system.

8. As our sun's motion may give apparent retrograde motions to some of the stars, it is of the first importance in sidereal astronomy to learn the point to which our sun is tending. In our search for this we may now confine our endeavors to a narrow zone in the heavens. The sun's motion must be nearly at right angles to the line drawn to the centre of our system. This motion therefore must be toward some point in the zone of the galaxy. The method hitherto employed to ascertain the direction of our sun's motion, is very deceptive. As we travel through a wood the trees appear to grow wider apart in front of us, and closer together behind us. The same principle has been applied to the stars, comparing them with the trees. But how could such appearances, wider and closer, occur among the trees, if those trees were all in motion as rapidly as ourselves? The other stars are moving like our sun. Therefore this tree method of learning our sun's motion, is liable to grave objections.

9. The zone of the galaxy varies in breadth on the face of the heavens, but on an average it is from eight to ten degrees wide. If we be $2\frac{1}{2}°$ from its median line or plane, then this wide band

stretches not only over our own position, but over all the stars of the first and second magnitudes in the direction away from the galactic plane, and also on the other side of that plane far beyond the stars visible to the naked eye. Where the zone of the galaxy is 8° wide, then, calculating from its distance, light requires 280 years to cross that zone. And where it is 10° wide, light requires 350 years to cross it. When we look at right angles away from the plane of the galaxy to the distant stars of the sixth magnitude, and also in the opposite direction on the other side of the galaxy to the distant sixth magnitude stars, and then look up at the galaxy itself, we see apparently a narrow milky band, but it is broader than the entire distance between the opposite stars of the sixth magnitude.

The other dimension of the galaxy at right angles to this, that is, the distance from its nearer to its further or outer surface, is probably four or five times greater. Its nearer stars, those of the ninth magnitude, require 2000 years for their light to reach us, but its more distant, those of the twelfth magnitude, require 3400 years. Therefore the difference of 1400 years is required for the passage of light from its more distant to its nearer stars. Considering the wide space existing within these dimensions, we cannot say that the galactic stars are nearer together than our sun and its neighboring stars. Moreover the specific gravity of the four outer planets of our solar system is many times less than that of the four inner planets. Saturn, for instance, is nine times lighter than Mercury. In like manner the galactic, or the outer stars of our sidereal system, may be many times lighter than our sun and his neighboring inner stars. From both these causes, distance apart and lightness, gravitation between the galactic stars may be less than that between our sun and his neighboring stars. This aids to understand why, from their apparent nearness together, the galactic stars are not brought by gravity in contact, or in very closely revolving systems, like binary stars.

10. By assuming with Herschel that the nearest part of the galaxy requires 2000 years for its light to reach us, we may then calculate its circumference, or the orbits of its stars, and the time required for those stars to make one revolution in their orbits. A star moving at the rate of 3000 miles per minute, about like that of Arcturus, must require 50,000,000 years for a single revolution around the sidereal centre. A star revolving at the rate of 2000

miles per minute, about like that of 6 Cygni, requires 75,000,000 years. And a star moving at the rate of 1000 miles per minute, about like that of our earth around the sun, requires 150,000,000 years for one revolution around the sidereal centre!

Assuming the very probable estimate of 2° between the galactic plane, or median line, and a parallel great circle, then 70 years are required for the passage of light from our sidereal centre to ourselves, and the following table gives the times for a single revolution of our sun, around that centre, at the three different velocities above recorded.

3000 miles per minute,	1,760,000	years	for	one	revolution.			
2000 " " "	2,640,000	"	"	"	"			
1000 " " "	5,280,000	"	"	"	"			

These almost endless periods teach some practical lessons. One is that the direction of our sun's motion for two or three centuries must be sensibly toward the same point in the heavens, or very nearly. If a star in the galaxy performs a revolution in 50,000,000 years, that is, with the velocity of 3000 miles per minute, then about 40 years are necessary for it to move through one second of arc, the smallest quantity measurable in astronomy. That is, if the position of a galactic star be taken and recorded with the most refined accuracy, then it will not be until the next generation of astronomers that the movement of the star can be recognized. If the velocity of the star be 2000 or 1000 miles per minute, then the time required to move through one second of arc must be in one case 60 and in the other case 120 years! No wonder that we cannot tell in which direction the Milky Way revolves. From the well-established intergravitation of the stars, we are sure that it must wheel around in its mighty circle, but we know not which way the wheel turns. This want of apparent motion in the galactic stars is proof positive of their vast distance. It confirms the same conclusion of astronomers founded on the smallness of this magnitude. We now see in a strong and clear light the importance of having portions of the galaxy mapped out, and their positions determined with the closest exactness, so that coming generations of astronomers may learn which way around the great Milky Way revolves.

The following reports were read and referred to the Publication Committee:—

REPORT OF THE PRESIDENT.

Several events in the history of the Academy have occurred during the year just closed which are worthy of notice or record.

On the 4th of January, 1876, the Society met in its hall at the northwest corner of Broad and Sansom Streets for the last time. It had been domiciled there since February 18, 1840, a period of very nearly thirty-six years. It held its first meeting in the north wing of the new edifice on Tuesday evening, January 11th. Possession of the old building was transferred to the purchaser the next day.

At the close of the sixty-fifth year since its foundation the Society may be justly congratulated on the progress it has made, in the extension of its museum and library, on the work recorded in its publications, and on the value of the real estate which it has acquired through the generosity of very many friends. It possesses a commodious fire-proof building (which is the north wing of the proposed structure), and a plot of ground upon which it can be extended. The Academy is free from debt, and its settled policy is to incur no pecuniary obligation before means to cancel it have been provided.

It seems not unreasonable to conjecture that the Society may be found occupying this same locality at the close of the second century of the nation, still endeavoring, under the benevolent precept *non sibi sed omnibus*, to acquire knowledge of the sensible creation and to diffuse it by all means at its command.

The propriety of representing the Academy through an exhibit of its publications, etc., in the International Exhibition, was suggested February 15th, and the committee then appointed—Dr. John L. LeConte and Messrs. Charles E. Smith and Wm. S. Vaux—reported substantially, March 7th, that it was inexpedient, and was discharged from further consideration of the subject.

The formal transfer of the building and site upon which it stands by the trustees of the building fund, in accordance with their suggestion, was postponed for the time, by a resolution adopted March 14th.

Under authority of a resolution of May 9th, an invitation to visit the museum and library as frequently as might be agreeable to them during their sojourn in the city was given to the commissioners accredited to the International Exhibition as well as to members and delegates of societies and associations which met in Philadelphia in the course of the year.

On specified conditions it was agreed, November, 1875, that the American Entomological Society should be received into the Academy, and on the 16th of May the report that the Entomological Section of the Academy had been organized, was made, in pursuance of a provision of the by-laws.

May 30th an application of members of the Society to form the Botanical Section of the Academy was approved, and the report that its organization had been completed was made June 20th.

The association of members occupied in a special branch of study into sections, besides being a source of gratification to them, is useful to the Academy. The collections placed in charge of the sections receive their particular care, and the Curators of the Academy are so far relieved from the necessity of giving special attention to their preservation and arrangement.

At present the Academy includes four sections, namely:—

The Biological and Microscopical Section.[1]

The Conchological Section.[2]

The Entomological Section.[3]

The Botanical Section.[4]

All members and correspondents of the Academy have the privilege of being present at the stated meetings of the sections.

August 31, 1875, the Council was requested to examine the by-laws and report such changes as may be necessary for the better government of the Academy. The Council deliberated long on the subject and recommended several important modifications. The series of amendments proposed by the Council were considered and debated at several meetings of the Academy, altered in many particulars, and finally adopted May 30th of the present year.

In conformity to one of these laws, on the 16th of May, twelve

[1] Stated meeting on the first Monday evening of every month.

[2] Stated meeting on the first Thursday evening of every month.

[3] Stated meeting, second Thursday evening of every month.

[4] Stated meeting, second Monday evening of every month.

councillors were elected, four for three years, four for two years, and four for one year.

Since the adoption of the new laws sufficient time has not yet elapsed to test satisfactorily their practical working. Some of the elder members of the Society doubt whether the changes made will prove to be better in practice than the displaced legal requirements. Perfection in by-laws of a society cannot be reasonably expected. The ordinary progress of events and changed conditions renders a modification of them from time to time desirable; and there is always ground for honest difference of opinion. Even the Constitution, the organic law of the United States, formed by the wisest and most judicious minds in the country, has been found, during the experience of a century, to require amendments.

In reference to one important feature of the new by-laws, I venture to make a few comments which I hope may not be considered out of place.

To the extent of its means the Society endeavors to diffuse information of what is known within the field of its labors, to increase the popular taste for natural science, and to assist those engaged in original investigations by granting to them the free use of its library and museum, and by publishing the results of their labors, in its Journal and Proceedings.

The Academy desires to extend the usefulness of its library and museum in this direction, and to project paths among the unknown things of the earth which men may pursue and retrace, always bringing back a revelation of some fact not previously known. It is believed that there are many men eminently qualified in all respects to engage in original research, whose scientific work is greatly restricted because almost all their time is necessarily spent in gaining a livelihood, who, like the Davys, Faradays, Huxleys, and Tyndalls of the Royal Institution, would gladly accept a moderate support of assured continuance, and in return for it devote all their energies to scientific investigations and teaching.

In the hope of increasing the number of original investigators by providing places for men of this character, and of securing systematic elementary and popular instruction by courses of lectures and otherwise, the Academy has modified its by-laws in such manner as to authorize the appointment of professors and assistant professors.

The plan is commendable, and its realization should be encouraged by the friends of scientific progress; but to realize it completely in all its details requires in the aggregate a very large sum of money.

In the present condition of the Academy's resources, the objection to this scheme is that to appoint professors before providing a laboratory in which they may pursue their investigations; or a lecture-room for the accommodation of those who would listen to their teachings; or means for their permanent and entire support, would be merely to bestow complimentary titles, without advancing the interests of original research in any manner or degree. Gentlemen elected to professorships without income would not find in the title of professor alone the means of living. Such title would not relieve them from the necessity of giving their time and labor to some exacting vocation in exchange for daily bread, nor afford them more leisure than they may possess without it. Those devoted to original investigation who are pecuniarily independent of secular employment do not need the assistance which hoped-for endowments are designed to give. As the library and museum are accessible to all for the purpose of study, they are in condition to pursue their scientific labors without acquiring the title of professor from the Academy.

The by-laws indicate that each professor will have exclusive control of such collections as may be assigned to his care, and be responsible for their arrangement, increase, and preservation. For partial or entire neglect of this very important duty, there seems to be no remedy of easy administration as long as it is confided to any one who has no right to compensation for his time and labor from the Academy. Where pecuniary consideration for services to be rendered is in any manner contingent upon their performance, there is an obvious and efficacious remedy for neglect.

If such objections have any force, they suggest that the interests of the Academy, and of science, will be best served by postponing the election of professors until after substantial endowments for their support have been secured. Until these are acquired the collections may be still properly confided, as they always have been, to the custody of the four curators, under whose care they have attained their present condition and magnitude, and in the mean time the Academy may continue its efforts to develop and make useful its resources.

The Emperor of Brazil, who is distinguished as much by his varied learning as by his high political position, was present at the stated meeting of the Society, held June 27.

On the evening of July 7, the gentlemen officially connected with the International Exhibition, and many others, were received and entertained in the Academy, the entire expense being borne by several generous members of the Society.

In August, Professor Huxley was invited, in anticipation of his coming to Philadelphia, to be present at the meetings of the Society, but he regretted his inability to accept the invitation. He arrived in the city about two o'clock P. M. of Thursday, Sept. 14, and spent two or three hours of the afternoon in the museum. The next afternoon he departed for New York.

At the instance of the Centennial Commission, a committee was appointed Oct. 10, "to investigate and report upon the introduction of new species of insects and plants through the medium of foreign exhibits at the Centennial Exhibition."

The report in relation to the introduction of insects, by Drs. J. L. Le Conte, Geo. H. Horn, and Joseph Leidy, was made Nov. 14. The labors of the botanists of the committee are necessarily deferred until the ensuing spring; the results of their observations cannot be expected until some time next year.

The stated meetings of the Society in the new locality, contrary to the anticipation of some of the members, have been more numerously attended than those in the old hall, and have been no less interesting.

In behalf of the council I have to report that its stated meetings have been regularly held, and the matters submitted to it have been carefully considered.

Respectfully, etc.,

W. S. W. RUSCHENBERGER.

REPORT OF RECORDING SECRETARY.

During the twelve months ending Nov. 30, 1876, ninety members and nineteen correspondents have been elected.

Announcement was made of the death of two members—J. S. Phillips and Geo. Washington Smith.

Twenty-seven papers have been presented for publication, as follows: Wm. H. Dall, three; Wm. M. Gabb, three; Edw. D.

Cope, two; Geo. A. Koenig, two; Mariano Bárcena, two; and J. A. Allen, H. C. Chapman, Chas. A. White, D. S. Jordan and H. E. Copeland, Geo. Hay, Harrison Allen, Isaac Lea, Wm. G. Mazyck, Herman Strecker, Chas. Pickering, Wm. G. Binney, J A. Ogden, Jos. Leidy, T. A. Conrad, and Theo. Gill each one. Dr. Leidy's paper and one of those presented by Mr. Gabb were accepted for the Journal; the others were ordered to be published in the Proceedings.

The verbal communications have been much more numerous than heretofore, scarcely a meeting having been held at which some subject of scientific interest was not discussed. These communications have been for the most part reported by their authors for publication in the Proceedings.

Reports of the meetings continue to be published in two of the evening papers with, it is believed, the good effect alluded to in my last report.

During the year the ninety-five concluding pages of the Proceedings for 1875, and two hundred pages for 1876, with ten lithographic plates, one of them colored, have been issued. No portion of the Journal has been published, but artists are employed on plates illustrating papers by Dr. Leidy and Mr. Gabb, and it is hoped that the next part may be completed during the coming year.

All of which is respectfully submitted,

EDWARD J. NOLAN,
Recording Secretary.

REPORT OF THE LIBRARIAN.

The Librarian respectfully reports that the additions to the library, during the twelve months ending November 30, 1876, amount to 2491. This is in excess of the increase for any other year of which we have a record, except that for 1850, when the late Dr. Thos. B. Wilson, and his brother Edw. Wilson, contributed a larger number of books than at any previous or subsequent period.

Of the additions during the past year 683 were volumes, 1784 pamphlets and parts of periodicals, and 24 maps, photographs, etc.; 1889 were octavos, 508 quartos, 44 folios, and 26 duodecimos.

They were derived from the following sources:—

Societies	1034	J. H. Redfield	
Editors	400	War Department	
I. V. Williamson Fund	350	Louis Godey	
Bequeathed by John S. Phillips	221	East Indian Government	
Authors	142	James Hall	
Wilson Fund	71	Wm. S. Vaux	
Brazilian Centennial Commission	35	Angus Mackay	
Department of the Interior	19	H. H. Higgins	
Dr. Jos. Leidy	15	Joshua Lindahl	
Isaac Lea	12	Dr. James Hector	
Geological Survey of Canada	12	West Virginia Centennial Commission	
Geological Survey of Spain	12	Mexican Commission	
Publishers	9	Chinese Commission	
Smithsonian Institution	9	Japanese Commission	
M. Lavoinne	9	Austrian Commission	
Adolph Sutro	8	Ward B. Haseltine	
Geological Survey of India	7	T. R. Peale	
Geological Survey of Sweden	7	J. S. Newberry	
Geological Survey of Penna.	7	Edw. Stabler	
Alfonso Herrera	7	Mr. Davies	
J. A. Ryder	5	Lorin Davenport	
Engineer Department, U. S. A.	5	Chas. Dury	
Dr. F. V. Hayden	5	Chas. S. Rand	
New South Wales Centennial Commissioner	5	D. S. Sheldon	
Treasury Department	4	Mrs. E. P. Gurney	
Thos. Meehan	4	G. M. Levette	
C. W. Williamson	4	K. Kuroda	
J. Laidlaw	4	Saml. Davenport	
Wisconsin Centennial Commission	4	Isaac Burk	
Dr. F. A. Hassler	3	Rev. Dr. Honeyman	
Minister of Public Works, France	3	W. C. Stevenson	
J. E. Cook	3	T. A. Conrad	
G. W. Tryon, Jr.	3	J. B. King	
Michigan Centennial Commission	3	Alex. Agassiz	
		Geological Survey of Illinois	
		Navy Department	
		Surgeon General, U. S. A.	
		Department of Agriculture	

They were divided as follows:—

Journals	1745	Chemistry	
Geology	177	Ichthyology	
General Natural History	159	Herpetology	
Conchology	129	Mineralogy	
Botany	55	Medicine	
Entomology	28	Encyclopædias	
Anatomy and Physiology	26	Mammalogy	
Ornithology	24	Bibliography	
Physical Sciences	24	Geography	
Anthropology	17	Education	
Helminthology	16	Agriculture	
Useful Arts	15	Antiquities	
Voyages and Travels	10		

One hundred and seventy-one volumes have been bound during the year, and 55 volumes are now in the hands of the binder. These include all the unbound books which have been credited to the Wilson and I. V. Williamson Funds, together with such journals received in exchange for the Academy's publications as are in constant use and likely to be damaged if left unbound. The volumes of other exchanges have been tied up, to remain in this condition on the shelves until the Academy is able to bear the expense of binding.

The early months of the year were occupied in transferring the library from the old building, and roughly placing the books in the new cases prepared for them. With the assistance of Mr. Russell Hill and Mr. J. A. Ryder, this work was accomplished in less time than it was supposed it would be necessary to devote to it, and the more careful classification and arrangement of the various sections have since proceeded as rapidly as circumstances would permit. The catalogues which were completed before the removal, have been revised so as to accommodate them to the new disposition of the books, and the current additions to the library have been added to the card catalogue. Special attention has been given to the arrangement of the journals and periodicals. The greater portion of this department has been carefully examined, all deficiencies have been noted, and fifty letters applying for parts required to complete sets have been written. The answers to these applications have been such as to warrant the belief that a much larger return will be secured by written requests to societies and editors than could be hoped for in answer to printed circulars, no matter how urgently they may be worded.

Various plans for the re-arrangement of the library in the present building have been suggested and considered, but the simplicity of the system of consecutive numbering of the volumes, adopted before removal, and the readiness with which, by means of it, any given book may be found, has caused the Library Committee to authorize its continuance. It will, however, be supplemented by a shelf or alcove catalogue of the recent additions to each department until they accumulate sufficiently to permit of their being numbered.

An examination of the library in April showed that it contained at that time 22,440 bound and 621 unbound volumes, and

1255 unbound pamphlets, which would probably form 125 volumes, making 23,186 volumes in all, exclusive of duplicates and the libraries of sections. If these be added the total will reach 25,495 volumes.[1]

Portraits in oil of Jacob Gilliams, M.D., and John Speakman, two of the founders of the Academy, were presented by Dr. Jas. S. Gilliams and Thos. Say Speakman respectively.

It will be seen by reference to the annual list of additions to the library how deeply the Academy is indebted to Mr. Isaiah V. Williamson for his munificent gift. Many of the most valuable publications of the last two or three years have been obtained by means of this fund, and the library is consequently better supplied with the recent literature of natural history than it has been since the death of Dr. Thos. B. Wilson. Much, however, remains to be added before the library in many of its sections can be considered as approaching a state of completeness, and it is earnestly desired that specialists will furnish the titles of such works as may be lacking in their departments. A catalogue of current scientific books already begun for the use of the Library Committee will be continued and kept as complete as possible. It is hoped that the means at the disposal of the committee are now sufficient to enable it to authorize the ordering of all approved books, while the titles of those works which it is not thought desirable to purchase immediately, will yet be kept for reference in the future.

All of which is respectfully submitted,

EDW. J. NOLAN, *Librarian.*

REPORT OF THE CURATORS FOR 1876.

The removal of the Museum of the Academy from the former building to the one now occupied, was completed before the close of the last year; the removal of the library immediately following and was completed in the first week of January of the present year. The first meeting of the Academy was held in the new building on the 11th of January.

Through the able superintendence and incessant labor of our colleagues, Messrs. Tryon and Parker, aided by Dr. James Ogden, Miss Sarah P. Monks, John A. Ryder, Russel Hill, and others, the different collections were so far arranged in the

[1] The increase of the year makes the aggregate of the library November 30, 1876, about 26,356 volumes.

respective places that the Museum was opened for exhibition to the public on the first of May. From that time to the present it has been open to visitors daily except on Saturday and Sunday. Since then, also, the regular and systematic arrangement of the collections of the Museum has continued in the usual manner.

Those departments of the Museum under the charge of special sections of the Academy have been equally well attended to in the arrangement of their appropriate collections. On the condition of these and the additions thereto during the year, I refer to the reports of the Conservators of the Sections.

In July, I regret to say, Mr. Tryon resigned his position as Curator. Dr. H. C. Chapman was appointed to fill the vacancy. Since that time the Museum has been mainly under the superintendence of Mr. Parker, whose services have proved so valuable that I hope the Academy may secure their continuance.

Mr. John A. Ryder has arranged the mammalian collection, and affixed labels when required. The crania of mammals are partially arranged and labelled.

The collection of human crania has been rearranged. (Mr. Parker reports the following skulls as missing: Nos. 210, 215, 223, 224, 227, 232, 401, 568, 719, 736, 843, 872, 878, 898, 981, 1039, 1042, 1050, 1067, 1236, 1246, 1282, 1348, 1414, 1479, 1485, 1557—in all 27.)

The collection of mammalian and bird skins has been thoroughly examined.

The ornithological collection has been arranged in the cases by Dr. James A. Ogden, Miss Sarah P. Monks, and Mr. Russel Hill. Miss Monks has identified, labelled, and catalogued the species of twenty-three families; and, in addition, has arranged and attached the generic and family names to those identified by her the previous year. Mr. Spencer Trotter has identified the species of the family Sylvicolidæ.

Mr. W. G. Freedley is arranging and labelling the collection of bird's eggs.

The alcoholic specimens of the Museum have received due attention.

The cretaceous vertebrate fossils have been carefully gone over and placed in a condition to prevent their destruction through the decomposition of the sulphide of iron with which they are impregnated.

The invertebrate fossils have been partially arranged by Mr. Russel Hill, under the supervision of Mr. Wm. M. Gabb.

Most of the specimens donated, deposited, and purchased during the year have been labelled and arranged in their appropriate places.

(Several valuable specimens of minerals are missing from the collection.)

The contributions to the Museum during the year are as follows:—

Mammals.—A mounted skeleton of the Giraffe, 18 feet high, a fine specimen from Africa, purchased in London in 1875, presented by Wm. S. Vaux and Henry C. Gibson.

A Dugong, in alcohol, presented by Mr. John Ching, Wide Bay, Queensland, through Mr. Angus Mackay, Commissioner of Queensland.

Two skeletons of Marmoset, presented by Dr. Ed. Hartshorne. A squirrel, from Mexico, presented by the Zoological Society. A monkey, *Semnopithecus entellus;* a leopard, *F. pardus;* a Sun bear, *Helarctos eurysplilus;* and a *Zalophus Gillespii*, deposited by O. B. Gross.

The following were also presented: a fœtal pig, by John Krider; a fœtal kitten, by C. F. Parker; a mouse with fungus growth, by P. F. Wells; a hydrocephalic skull of a calf, by Mrs. A. A. Crawford; and an irregular osteo-dentinal growth from the tooth of a sperm whale, by S. Powel.

Birds.—A black-throated quail, *Ortyx virginianus* var. *Hoopesii*, and a Trumpeter Swan, *Cygnus americanus*, presented by John Krider. A Massena partridge, *Cyrtonyx massena*, from Neuces R., Texas, presented by Lieut. A. C. Markley, U. S. A. A young heron, from New Jersey, presented by John Mays. An albino King bird, from New Jersey, presented by George W. Earle. Four bird skins, presented by John Wagner, through the Zoological Society.

Ten specimens, five species of bird skins, from Demarara, presented by Col. P. Figgelmesy, U. S. Consul, Demarara.

A finely mounted American eagle, from Arkansas, presented by Dr. George W. Lawrence, Commissioner.

The following were also presented: Five eggs of the Sage fowl, by Dr. J. Van A. Carter; three eggs of the Jew bird, *Crotophaga*, a Domingo, by Wm. M. Gabb; three eggs of *Larus argen-*

tatus, by C. Mann; a nest of the Oriole, by Thos. L. Cernea; and a nest, by S. S. Haldeman.

A *Cygnus olor* was deposited by O. B. Gross.

Reptiles, Amphibians, and Fishes.—Fourteen jars of reptiles from British Guiana, presented by Mr. Gilbert, of Demarara, through Mr. A. A. Outerbridge, Commissioner for British Guiana. Eight species of reptiles, from Trinidad, presented by Col. P. Figgelmesy. There were also presented a small collection of reptiles, from San Domingo, by Wm. M. Gabb; and another from Port au Prince, Hayti, by Thomas Bland. Two snakes, from Pocono, by T. Wagner and R. Fulmer. Several salamanders, from Brush Mt., by Rev. H. C. McCook. A terrapin, by Mr. Mather; and several turtle eggs, by J. A. Ryder.

Forty-two specimens, forty-one species of fishes, from South America, collected by the Hassler Expedition, and forty-five specimens of twenty-six species, from the United States and West Indies, were presented by the Museum of Comparative Zoology of Cambridge, Mass.

Forty-eight specimens of thirty-six species of fishes, mostly from the U. S. Atlantic coast, presented by E. D. Cope.

Six species of fishes, from Janira R., San Domingo, and one Flying-fish, were presented by Wm. M. Gabb.

The following were also presented: A salmon trout, from Hobart Town, Tasmania, by the Tasmanian Salmon Commisson; several viviparous fishes, from Vancouver Isl., by A. C. Engard; two shad and an alligator Gar, from Ouchita R., Ark., by Dr. G. W. Lawrence; a Lucioperca and an Amia, by E. D. Cope; a *Platyrostra edentula* and *Megalops trissoides*, by the U. S. Fish Commission; a Lump fish, from Barnegat Bay, by D. M. Yost; a Tunney, from off Atlantic City, by R. Buckman; a Saury, from the same locality, by Geo. W. Bugbee & Co.; *Selene argentea*, *Alutera cuspidata* and *Carangus*, Squan R., N. J., by W. H. Dougherty; three species of fishes from the same river, by Jos. Willcox; *Mustelis canis* and *Anguilla*, Atlantic City, by Geo. W. Tryon, Jr.; *Engraulis*, by T. P. Parker; palatine teeth of drum fish, by J. F. Leaming; jaws of a fish, by Mrs. A. A. Crawford; and photograph and scale of the Tarpum, by R. Bridges and S. Powel.

A small collection of reptiles and fishes, from South America, was presented by Dr. C. Hering, and another collection from various localities was presented by Dr. F. B. Stevenson, U. S. N.

Articulates.—A small collection of insects, etc., from Port au Prince, Hayti, was presented by Thomas Bland; a small collection of crustaceans and spiders, by Dr. F. B. Stevenson, U. S. N.; a small collection of crustaceans, from San Domingo, by Wm. M. Gabb; a small collection of myriapods, from Iowa, by D. S. Sheldon through Dr. H. C. Wood; three *Scolopendra*, from Trinidad and Demarara, by Col. P. Figgelmesy; seven species of spiders, from Costa Rica, by Wm. M. Gabb; *Calappa convexa*, by Capt. L. D. Barrett; *Platyonychus ocellatus*, by G. W. Tryon, Jr.; *Alaus occulatus*, E. S. Whelen; *Polydesmus*, by J. O. Shimmel; a grasshopper, from Guayaquil, by C. S. Rand; larva of *Cuterebra*, from the skin of a rabbit, by Prof. J. Lawrence Smith; a beetle with fungus growth, by T. Pennington Conrad; and a hornet nest, by W. R. Jones.

Radiates and Protozoans.—A superb collection of thirty-seven corals, from Key West, Florida, presented by Wm. S. Vaux.

A fine collection of seventeen corals, presented by Clarence S. Bement.

Seventeen species of Echini, and a large Neptune's cup sponge, presented by Dr. Isaac Lea.

Six corals, from Samoan Islands, and one coral from Alaska, presented by J. M. Emanuel.

A Gorgonia and an Ophiura, and one hundred bottles of marine dredgings, etc. (including protozoans, radiates, annelides, crustaceans, mollusks, etc.) from the Pacific, presented by Dr. Wm. H. Jones, U. S. N.

A small collection of echinoderms in alcohol, from various localities, presented by Dr. F. B. Stevenson, U. S. N.

A coral, from Bermuda, presented by J. P. Hand; and an Echinus, *Hipponoë esculenta*, Caribbean Sea, presented by A. Duer, through Mr. Dougherty.

A fine large specimen of *Madrepora palmata*, from Turk's Island, was purchased.

There were also presented three sponges, from Turk's Island, by Wm. M. Gabb; and a Halicondria, from Egg Harbor Bay, N. J., by W. H. Dougherty.

Fossils.—A fine series of fossil foot tracks in slabs of red sandstone, together with a collection of remains of fishes, from the valley of the Connecticut, presented by Dr. Isaac Lea. To the same donor we are indebted for teeth and other remains of *Mastodon*, of *Ichthyosaurus*, etc.

A collection of fossils from the phosphate beds of Ashley R., S. C., consisting of vertebræ of squalodonts and cetaceans, the beak of a ziphioid cetacean, teeth of sharks, etc., was presented by Clarence S. Bement.

Portion of the femur of *Megatherium*, vertebra of *Squalodon*, teeth of *Equus major*, and dental plate of *Myliobates*, from the Ashley R. phosphate beds, presented by Mr. George T. Lewis.

Teeth and vertebræ of *Mosasaurus*, from Lumberton, Burlington Co., N. J., presented by Thomas Moore through Col. T. M. Bryan.

Three different small collections of shark's teeth and other remains of fishes and of reptiles, from the vicinity of Vincenttown, N. J., presented by Col. T. M. Bryan.

There were also presented the following: cetacean vertebra, from Ashley R., S. C., by S. Thayer Abert; tooth of *Mastodon andium*, from the Amazon, by Dr. Isaac T. Coates; cast of the lower jaw of the Cohoes Mastodon, presented by Prof. James Hall; remains of *Sphenosaurus clavirostris*, by S. S. Haldeman; do. of fishes from the mesozoic red shale of Montgomery Co., Pa., by Prof. Joseph Leidy; *Emys wyomingensis*, from Ft. Bridger, Wyoming, by Dr. J. Van A. Carter; tooth of *Carcharodon megalodon*, from Chesapeake Bay, by J. O. Schimmel; and coprolites, from Cambridgeshire, England, by Joseph P. Hazard.

Other fossils received by the Academy consist mainly of invertebrate remains.

Mr. Wm. M. Gabb, always a liberal donor to the Academy, as well as an active contributor to geological science, has presented the following collection:—

Sixty species of cretaceous fossils, mostly original types; 42 eocene fossils, from Texas, all original types; 31 miocene, 23 pliocene, and 85 post-pliocene fossils, of California, many original types; 42 species of post-pliocene fossils of San Domingo, and 72 pliocene fossils of Costa Rica. Mr. Gabb also presented 45 species of cretaceous fossils, most of which are described in his paper of November 7th.

Mr. Gabb further presented 225 specimens of 114 species of cretaceous fossils of India, being duplicate types of the "Palæontologia Indica," and labelled by Dr. Stoliczka.

Our venerable friend, member, and ever zealous student of natural history, Dr. Isaac Lea, has presented a collection consisting of 250 species of secondary and tertiary fossils, American

and European, and 14 South American cretaceous fossils, types of his paper in the Trans. Am. Phil. Soc., 2d ser., vol. vii. He has also presented a collection of 40 species of American and foreign palæozoic cretaceous and tertiary fossils.

A collection of forty-seven lower carboniferous fossils, and five others from the lower coal measures from Jefferson Co., Alabama, were presented by Dr. Wm. Gesner.

Three fine specimens of *Eurypterus remipes*, from the Waterlime group, near Buffalo, N. Y., presented by Tobias Witner, Esq., through Prof. S. S. Haldeman.

Twenty palæozoic brachiopods, from Huntingdon Co., Pa., were presented by John M. Hartman.

Forty-four devonian and silurian fossils, comprising brachiopods, corals, and a large slab of shale with a multitude of trilobites, etc., from Ontario, Canada, presented by Thos. Burnett.

Twenty species of cretaceous fossils, from New Jersey, and a collection of minute fossils, comprising many specimens and species, from the cretaceous limestone of Vincenttown, N. J., presented by Col. T. M. Bryan.

Of other invertebrates, the following were presented: a collection of shells from the Paris basin, etc., and encrenites, by Dr. Isaac Lea; a collection of marl fossils from Vincenttown by Col. Bryan; cobble stone with *Scolithus linearis*, from drift, Washington, D. C., by Prof. Wm. B. Rogers; numerous *Amnicola galbana*, Sussex Co., N. J.; *Inoceramus* and another cretaceous fossil, from Texas; and *Inoceramus barabeni*, Selma, Alabama, by Prof. Haldeman; *Ammonites obtusus*, England, by Miss Mary Haig; coral, Luzerne Co., Pa., by E. K. Bryer; *Gryphæa vesicularis*, New Jersey, by W. H. Dougherty; *Avicula*, Munroe Co., Pa., by C. F. Parker; two Orthoceratites, Arkansas, by Dr. G. W. Lawrence; a new species of Nautilus from Vincenttown, N. J., by Col. Bryan; seven fossils from Hayti, by Thos. Bland; several from New Jersey, by Mr. Gabb; and a Gryphæa and an Ammonite from Hemstead Co., Ark., by Dr. Geo. W. Lawrence.

Of fossil plants, Dr. George W. Lawrence, Arkansas Commissioner, presented two large silicified trunks, measuring each upwards of four feet in length and a foot in diameter, from Hot Springs Co., Arkansas. Dr. Isaac Lea presented nine fossil plants, and Dr. Lawrence one coal plant from Arkansas.

Minerals. — Among the most interesting of the minerals

given to the Academy, is a collection of fifty-six specimens of Ozocerite and the associated rock strata, from Boryslaw, Carpathian Mountains, Galicia, presented by Paul Dobel through Dr. F. Migerka, Austrian Commissioner.

A crystal of Barytes, sixty pounds weight, from Dufton, Cumberland, England, was presented by Wm. S. Vaux. The following were also presented by the same gentleman: a large crystal of Apatite, from Burgess, Canada; Anglesite, Phœnixville, Pa.; Brown Tourmaline, Governeur, N. Y.; Apophyllite with Analcime; and Datholite, from Bergen Hill, N. J.

Dr. Isaac Lea presented the following: one hundred specimens of rocks from Scotland; thirty-seven do. from a coal shaft, England; forty do. from the route from Cruces on Chagres R. to Panama; eight additional rock specimens; thirty-five coprolites and septaria from near Edinburgh; a mass of mesozoic conglomerate, Plymouth, Montgomery Co., Pa.; Clinochlore in Chlorite, from Chester Co., Pa.; Magnetite, from Tilly Foster Mine, N. Y.; and a specimen of silicified wood. Dr. Lea also deposited an iron meteorite, weight two hundred and fifty-four pounds, from the mountains of East Tennessee.

Mr. Joseph Willcox presented collections consisting of two Rutiles, Georgia; two Apatites, Canada; Sulphur, Nevada; four Houghite, Strontianite, all St. Lawrence Co., N. Y.; Emerylite, Cyanite, N. Carolina; Pyrophyllite, S. Carolina; Tremolite, Conn.; Hornblende, N. J.; Tourmaline, three Anthophyllite, Del. Co.; two Actinolite, Fibrolite, Deweylite, Chester Co.; Mesolite, Nova Scotia; Zoisite, Ducktown, Tenn.; Pyrite, Columbia Co.; Tachylite, Nova Scotia; and Pyrophyllite, N. Carolina.

A fine specimen of Fire Opal, from Zimapan, Mexico, was presented by Prof. Mariano Bárcena.

A collection of minerals from Arkansas, consisting of Quartz and its varieties, Arkansite, Rutile, Schorlamite, Garnet, Magnetite, etc., was presented by Dr. Geo. W. Lawrence.

Fifty-nine rocks and minerals of Brazil, presented by Dr. J. M. da Silva Coutinho, Secretary of the Brazilian Commission.

A collection consisting of Sussexite, Jeffersonite, Rœpperite, and Calamine, from Franklin, Sussex Co., N. J.; Unakite, North Carolina; Copper, Lake Superior; Dendrites in shale; and eight Hematites and Limonites, Michigan, presented by John M. Hartman.

Two Satin-spars, England; Gypsum, Michigan; a collection of rocks, mostly fragments of boulders, eleven other rocks; two calc-tufas, and five fragments of glacial polished rocks, from Niagara, presented by Thomas Burnett.

Of other minerals, there were presented the following:—

Manganite, Ihlfeld, Hartz; Aragonite, Herrngrund, Hungary; two Arkansites, and a Rutile, Magnet Cove, Ark., presented by C. S. Bement. Vivianite, from Vincenttown, N. J., by Col. T. M. Bryan. Diaspore, from near Unionville, Chester Co., by T. F. Seal. Cassiterite, Durango, Mexico, by S. C. Bruce. Peat, Ireland, by Mary Mulholland. Two phosphatic nodules, Ashley R., S. C., by Geo. T. Lewis. Mullicite, Mullica Hill, N. J., by T. D. Rand. Native Mercury, Cal., by Dr. T. H. Streets. Strontianite, Mifflin Co., Pa., by H. C. Lewis. Serpentine, Harford Co., Md., by Wm. Struthers. Four topazes, Bass' Straits, by Miss Hull. Copper, Lake Superior, by B. A. Hoopes. Eleven iron ores, Alabama, by Dr. Wm. Gesner. Sixteen iron ores, Bohemia, by W. Nedwied & Son, through Dr. F. Migerka. Magnetic iron, Costa Rica, by W. M. Gabb. Three Graphites, Canada, by the Plumbago Co., Ottawa, Canada. Stibnite, Blende, Galena, Chalcopyrite, etc., Arkansas, by W. E. Powell. Gypsum and Kaolin, Ark., by Thomas Essex. Sphene and casts of crystals, Chester Co., Pa., by W. H. Forwood, M.D. Two Calcites, Montana, by V. E. Cline and P. Barhite. Celestine, Blair Co., Pa., by Rev. H. C. McCook. Four auriferous Quartzes, Chalcopyrite and Garnet, Siberia, by Dr. S. H. Linn. Halloysite, Indiana, by Mr. Dougherty. Halloysite, N. Y., by E. Goldsmith. Fichtelite, Bavaria; and four rocks from Lehigh and Delaware Co., by Dr. Leidy. Seven minerals, Australia, by J. M. Emanuel. Rose chalcedomy, California, by W. H. Dougherty.

There were also purchased: Hornblende, from Edwards, N. Y., Heulandite, Iceland; Garnet, Chester Co., and a fine crystal of Amazon stone, Pikes' Peak, Colorado.

Ethnological and Miscellaneous.—A collection of American Indian stone relics, from Arkansas, was presented by Dr. G. W. Lawrence.

A collection of ten pieces of pottery, etc., from Nicaragua, was presented by Dr. J. H. Bransford, U. S. N.

Twelve pieces of pottery, from Peru, and three pieces of tapa cloth from Hawaii, etc., presented by Dr. W. S. W. Ruschenberger.

In addition, the following were presented:—

A fossil tooth of *Carcharodon magalodon*, artificially shaped into an Indian implement, taken with stone relics, etc., from a shell heap at Cedar Keys, Florida, by R. M. Smith. Rope, mat, and paper, from the Samoan Island; native sword, fans, etc., from Fiji Isle, and opium pipe, from China, by J. M. Emanuel; several arrowheads and chips, from shores of Delaware; an arrowhead from Tennessee, and a pestle from New Jersey, by Dr. I. Lea. An Eskimo ice-pick, by Prof. S. S. Haldeman; stone hatchet and arrowhead, Glassboro, N. J., by Charles Berry; an arrowhead from Ohio, by T. C. Heighway; and a peculiar stone relic, by Mr. Trimble.

Dr. R. M. Bertolet deposited a collection consisting of one hundred and eighty-two arrowheads, two axes, one chisel, etc., besides forty-six specimens consisting of axes, pestles, pottery, carved pipe bowl, etc.

Respectfully submitted by

JOSEPH LEIDY,
Chairman of Curators.

REPORT OF RECORDER OF BIOLOGICAL AND MICROSCOPICAL SECTION.

The extraordinary demands upon the time, attention, and resources of Philadelphia physicians, throughout the centennial year, consequent upon the meeting in this city of the International Medical Congress, the American Medical Association, and the Pennsylvania State Medical Society, have seriously interfered with the prosecution of scientific research among our members during the past twelvemonth. On the other hand, however, by way of compensation, the presence of representative scientists from all parts of the world in attendance upon these conventions and on the Centennial Exhibition itself, has not only rendered the discussions at our meetings of the section more interesting and instructive, but has enabled us to give on the 16th of October last, by far the most successful microscopical exhibition and conversazione that has ever been organized in this city.

As remarked by the editor of a well-known Journal of Microscopy in concluding his account of the exhibition: "Altogether the meeting was a most pleasant and instructive one. It brought

together face to face a large number of men who had known each other by reputation for years, but who had not previously met, and it afforded such an opportunity for comparing the different forms of microscopes as does not often occur."

During the year communications have been presented by Dr. J. Gibbons Hunt, "On the Potato Fungus," "On the Study of Embryonal Tissue," "On Aleurone," "On The Lasso Cells of *Physalis Caravella*;" by Dr. J. H. McQuillen, "On *Sporendonema musca*;" by Dr. Carl Seiler, "On an Economical Heliostat," "On a New Cement for Glycerin Mountings," "On a Novel Method of Silver Staining with the Iodine and Bromine Compounds;" by Prof. T. G. Wormley, of Columbus, Ohio, "On Improved Double Slides of Red Blood Corpuscles;" by Dr. H. Allen, "In regard to Microscopic Changes in Mucous Membranes after Topical Medication;" by Mr. J. Zentmayer, "On the Improved Large American Microscope;" by Mr. W. H. Walmsly, "On the Double Staining of Vegetable Tissue;" by Mr. D. S. Holman, "On a New Form of Life Slide;" and by Dr. J. G. Richardson, "On the *Amphiuma* (or *Muranopsis*) *tridactylum*."

All of which is respectfully submitted,

JOS. G. RICHARDSON,
Recorder.

REPORT OF THE RECORDER OF CONCHOLOGICAL SECTION.

The Recorder of the Conchological Section respectfully reports that the malacological papers accepted by the Academy, and published in its Proceedings during 1876, aggregate 26 pages, as follows:—

Wm. G. Binney,	10 pages.	C. A. White,	7 pages.
Wm. H. Dall,	4 "	T. A. Conrad,	2 "
R. E. C. Stearns,	2 "	W. G. Mazyck,	1 "

A valuable paper entitled "Description of a Collection of Fossils made by Dr. Raimondi in Peru," by Wm. M. Gabb, and fully illustrated, is also in course of publication in the Journal of the Academy.

For a list of donations to the library, see report of the Librarian of the Academy.

The principal donation to the museum was the fine collection of

the late John S. Phillips by bequest. Of this valuable acquisition, 2584 specimens have been labelled and mounted in 938 trays. Few of these are specific novelties, but they add either to the varieties or the geographical suites. It is estimated that an equal number may be added from portions of this cabinet not yet examined. The aggregate of specimens labelled and mounted during the year is 2913 specimens in 1104 trays.

At its November meeting the Section appropriated $235.00 for fitting glass sashes in the drawers beneath the shell cases. When this work is completed, the collection will occupy a total space of 4765 square feet, or more than two and a half times as much as that occupied in the old building.

The officers of the Section for 1877 are—

Director	W. S. W. Ruschenberger.
Vice-Director . . .	William M. Gabb.
Recorder	S. Raymond Roberts.
Secretary	E. R. Beadle.
Treasurer . . .	William L. Mactier.
Librarian	Edward J. Nolan.
Conservator . . .	Geo. W. Tryon, Jr.

The following is a list of donations to the Conchological Cabinet, taken from the Report of the Conservator of the Section:—

Avicula, from the South Sea Islands. Presented by Dr. W. H. Jones, U. S. N.

Physa gyrina, Say. From Watkins Glen, N. Y. Presented by John H. Cooper.

Eleven species of *Unio*, *Anodonta*, *Etheria*, *Iridina*, and *Monocondylæa*. From Cambodia, the Nile, and New Caledonia. Presented by S. S. Haldeman.

Helix Van Nostrandi, Augusta, Georgia, and six species of *Bulimus* and *Cylindrella*. Presented by Thos. Bland.

Group of Eggs of *Ampullaria depressa*, Say. From Florida. Presented by Joseph Willcox.

The collection of shells of the late John S. Phillips, comprising about 2500 species, together with the cases containing the same. Bequeathed by him.

Oyster shell with eggs attached. Presented by C. M. Hyatt.

Twenty-seven specimens of *Helix rareguttata*, Mouss. Java.

Four specimens of *Helix puella*, Brod.; five *H. pulcherrima*, Sowb.; and six *H. argillacea*, Fer., Timor, Philippines. Presented by Mr. Gregory.

Fifty species of European shells, and thirty-eight types of Mühlfeldt's Genera of Mollusca. From Dr. I. Lea.

Helix ænigma, Dohrn. From New Granada. Presented by Thos. Bland.

Six species of shells. From Samoan Islands. Presented by J. M. Emanuel.

Two specimens of *Vivipara lineata*, Val.; *Pupa contracta*, Say; *P. armigera*, Say; and *Conulus chersina*, Say. From Davenport, Iowa. Presented by D. S. Sheldon.

Several specimens of *Cypræa moneta*. From Rutgers College in exchange.

Eggs of *Loligo punctata*, DeKay; specimens of nidus of *Natica; Ilyanassa obsoleta*, Say; *Natica duplicata*, Say; *Mya arenaria*, Lin.; *Mactra solidissima*, Ch., and seven other species. From Atlantic City, N. J. Presented by Geo. W. Tryon, Jr.

Eight specimens of *Hemimactra solidissima*, Chemn. From Atlantic City, N. J. Presented by Geo. W. Tryon, Jr.

Ten specimens of *Helix terrestris*, Ch. From Charleston, S. C. Presented by G. Mazyck.

Three specimens of *Microphysa Ingersolli*, Bland, Animas Valley, So. Colorado. Two *Pupilla alticola*, Ingersoll, Howardsville, Colorado. Presented by Ernest Ingersoll.

Two specimens *Dædatochila avara*, Say. From St. John's River, Fla. Two *Liostracus Dormani*, W. G. Binney, from Florida. Two *Helix Cumberlandiana*, Lea. From University Place, Franklin Co., Tenn. Presented by Chas. Duey.

Fifteen species of Marine Shells, from Santo Domingo and Turks Island, W. I. Presented by Wm. M. Gabb.

Respectfully submitted,

S. R. ROBERTS, *Recorder.*

REPORT OF THE CONSERVATOR OF ENTOMOLOGICAL SECTION.

In presenting this, the first annual Report of the Entomological Section of your Academy, the conservator of the same feels that it is difficult to render full justice to the Section at this time. Tl

Section as yet is in its childhood, and some time will be required to fully develop its vigor.

The American Entomological Society constitutes in its relation to the Academy of Natural Sciences the Entomological Section of the latter. Though working under different titles, they are essentially one and the same.

Under the terms mutually agreed upon by the two societies, the American Entomological Society held its first meeting in the building of the Academy on Feb. 14, 1876. After that meeting, the members of the Entomological Society took such action as was deemed necessary, culminating in a meeting held May 12, at which the Entomological Section of the Academy of Natural Sciences was fully organized, and entered upon the transaction of business as such. The American Entomological Society thereupon passed resolutions, directing that only two meetings should be held by it each year, said meetings to be held in June and December, for the transaction of business strictly belonging to it, and that all other stated meetings were to be those of the Section.

Under the above rule the Section has held thus far seven meetings, with an average attendance of seven members.

The meetings of the Section are held on the second Friday of each month.

During the past seven months, nine entomological papers have been presented for publication in the Transactions of the Society; seven of which have been reported upon affirmatively, and two are yet in the hands of committees.

Two members of the Academy have been elected members of the Section in addition to those originally constituting the same.

The conservator would report that the specimens in the collection of the Section are in good condition. He is not prepared to state at this time the actual number of specimens in the collection, the large number of undetermined specimens making it impossible for him to do so.

At a meeting of the American Entomological Society, held December 11th inst., the following was presented:—

"*Resolved*, That the sum of one hundred dollars from the funds of the Society be donated to the general fund of the Academy of Natural Sciences," which resolution passed by a unanimous vote.

Together with the above resolution, an order on the treasurer

of the American Entomological Society for $100 is herewith presented to the Academy.

The following have been elected to fill the several offices of the Section for the year 1877:—

Director	John L. LeConte, M.D.
Vice-Director	Geo. H. Horn, M.D.
Secretary	C. A. Blake.
Recorder	J. H. Ridings.
Treasurer	E. T. Cresson.
Conservator	James Ridings.
Publication Committee	E. T. Cresson, J. L. LeConte, M.D., Chas. A. Blake, Geo. H. Horn, M.D., Chas. Wilt.

JAMES RIDINGS, *Conservator.*

REPORT OF THE CONSERVATOR OF THE BOTANICAL SECTION.

The Conservator presents this first report since the organization of the Botanical Section, upon the condition of, the additions to, and the needs of the Academy's Herbarium. The Section has been so recently established, that such a report may be expected to be but imperfect, and to be regarded rather as preliminary than otherwise. But as much work has been done during the year by the Committee on Botany, appointed under the old by-laws of the Academy, aided by the volunteer efforts of other members, who will, it is hoped, continue to co-operate with the Section, it will be proper to embrace a retrospect of what has been done during the whole year.

And first, the Conservator would congratulate the members of the Section and of the Academy, as well as the scientific public, that the botanical treasures of the Academy have been exhumed from the dusty and dingy den in which they were entombed in the former building, and that they are now made really accessible to students. The removal was accomplished at the beginning of the year. Before attempting to re-arrange the collection, the leading Herbaria of the country were visited, and the details of their

arrangements examined. For very valuable suggestions in this regard we are indebted to Prof. Gray, of Cambridge; and also to Prof. Eaton, of New Haven; and to P. V. Leroy, the Curator of the Torrey Herbarium, at Columbia College, New York. Our own Curators, availing themselves of these and other suggestions, have spared no pains or expense in fitting up for our department a series of shelves and cases which fully meet our present wants, and which are in every way suitable to the careful preservation of the plants, and for facility of comparison and study. It is due to Mr. Tryon to say that, fully appreciating our needs in this respect, he entered heartily into the plans, and, as Curator, gave them his careful supervision.

These cases were completed about the 1st of May, and the labor of transferring the plants from the old unwieldy portfolios to the new shelves was carried on and completed during the summer mainly by the aid of Messrs. Meehan, Burke, and Parker. Among the packages removed from the old building were enormous piles of duplicate specimens which had been accumulating for years, some of which had lain buried, suffering from the ravages of insects, and few of which had been carefully examined. These, by the labors of Messrs. Burke, Meehan, Schimmel, Leffman, and others, have been examined, the ruined plants thrown out, and the remainder brought into some kind of partial arrangement, which, when completed, will enable us to select from these stores such specimens as may be desirable for the Herbarium, and to render the remainder useful for purposes of exchanges. This labor our Committee on Duplicates will doubtless continue and complete.

The Committee on the Herbarium, at its last meeting, decided on the general arrangement of the collection on a plan similar to that adopted at the Kew Gardens, and at Dr. Gray's Herbarium at Cambridge. The Conservator is now preparing the necessary tablets for displaying the names of the Natural Orders, and the lists of the Genera in each order. When this work is completed, the ease of consulting the Herbarium will be vastly increased, and any one of the 9000 known genera may be turned to, as readily as to a word in the dictionary.

During the past year the following donations have been received for the Academy's Herbarium:—

1-5 lots of cones of Coniferæ, and acorns of Oaks. Presented by Josiah Hoopes.

31 species of Plants, collected near Peking, China, by Rev. S. Wells Williams, 1868-9. Presented by John H. Redfield.

171 species of Plants, from Norwegian Mountains, collected by Prof. Willhelm Bork. Presented by Dr. H. C. Wood.

Leaves of *Argyroxiphium Sandwicence*, from the volcanoes of Kileau, Hawaii, Sandwich Islands. Presented by J. A. Ryder.

Branch of *Pinus pungens*, bearing cones. Presented by Dr. Isaac Lea.

Specimen of *Gaylussacia brachycera, Gray*, from Millsborough, Sussex County, Delaware. Collected and presented by W. M. Canby.

Specimen of Rice Grass, *Paspalum*, from prairies, Sedgwick County, Kansas. Presented by Atchinson, Topeka, and Sante Fé Railroad Company.

Sample *Alfalfa*, raised by W. H. Egan, Sedgwick County, Kansas. Presented by Atchinson, Topeka, and Sante Fé Railroad Company.

Specimen of *Habenaria rotundifolia*, from N. Vermont, a new locality. Presented by Dr. A. Gray.

Several specimens of *Salix longifolia*, with abnormally developed buds, produced by the sting of an insect. From the banks of the Pecos River, Texas. Presented by Lieut. A. C. Markley.

Specimen of *Onoclea sensibilis*, L., Var. *obtusifolia*, Torr., from near Germantown. Presented by Isaac C. Martindale.

Bark from which Tapa cloth is made. From Samoan or Navigators' Islands. Presented by Dr. Ruschenberger.

Specimens of *Leonurus glaucus*, collected near the mouth of Wissahickon Creek. Presented by I. C. Martindale.

Hydnum ——? Presented by Mr. Whelen.

Cone of *Pinus coulteri*, *Cupressus*, n. sp., and *Pinus sabriniana*. From California. Presented by Mr. Begg.

A collection of Woods, Coffee, Cotton, Fibres, Bark, Seeds, Resins, India-rubbers, Leaf Tobacco, Sarsaparilla, Cone of *Aurocaria*, etc. From Brazil. Presented by Dr. Jose de Saldanha da Gama, of the Brazilian Commission.

Cypress Knee, from Arkansas. Presented by Dr. Lawrence.

Specimens of Cotton, Millet, etc., from Arkansas. Presented by Dr. Geo. W. Lawrence.

Four species of Ferns: *Asplenium pinnatifidum*, *A. trichomanes*, *A. montanum*, and *Trichomanes radicans*. Collected at

Rock Castle Springs, Kentucky. Presented by Miss G. H. Rule, through J. C. Martindale.

Cone of *Pinus Torreyana*, Parry, from Southern San Diego County, California (Pallner Collection, No. 368). Presented by John H. Redfield.

As regards the future needs of our Herbarium, both as to arrangement and as to perfecting the collection, the Conservator has but too recently entered upon his duties to speak fully. It is sufficient now to say that there is already apparent the need of an enormous amount of labor, both scientific and mechanical, and of considerable expenditure, to make our collection what it ought to be. The completion of the Order tablets, and the arranging of the plants in the new genus covers, will absorb much labor, but will require little expenditure beyond what has already been incurred. But we must look forward to the day when the whole of our large collection shall be properly mounted upon paper, as the only way to preserve the specimens from injury in handling, and from a still greater danger, that of confusion arising from misplacing of labels. There is great reason to believe that we have suffered very greatly from such misplacement in times past, and that many type specimens of Nuttall and others have become subjected to doubt, and thus deprived of value. But before this consummation can be properly reached, there is a vast amount of careful, conscientious, and critical scientific work to be done, especially in the general Herbarium, in the re-elaboration of the determinations, culling out of rubbish, and replacement of inferior specimens by better, and in cataloguing with reference to the supply of our deficiencies.

In all these departments there is plentiful room for the labor of all the young botanists of the Academy, and for all the knowledge of the older ones.

JOHN H. REDFIELD,
Conservator.

The election of Officers for 1877 was held in accordance with the by-laws with the following result:—

President . . .	W. S. W. Ruschenberger, M.D.
Vice-Presidents . .	Wm. S. Vaux,
	J. L. LeConte, M.D.

Recording Secretary .	Edw. J. Nolan, M.D.
Corresponding Secretary	Geo. H. Horn, M.D.
Treasurer . . .	Wm. C. Henszey.
Librarian . . .	Edw. J. Nolan, M.D.
Curators . . .	Jos. Leidy, M.D., Wm. S. Vaux, Chas. F. Parker, H. C. Chapman, M.D.
Councillors to serve three years	J. S. Haines, Geo. Vaux, Wm. H. Dougherty, Aubrey H. Smith.
Councillors to serve an unexpired term of two years	Jos. Wharton, Chas. P. Perot.
Finance Committee . .	Wm. S. Vaux, Aubrey H. Smith, Edw. S. Whelen.

ELECTIONS DURING 1876.

MEMBERS.

January 25.—Rev. W. Q. Scott, Dr. Henry M. Fisher, Dr. Alfred Whelen, Dr. W. F. Waugh, U. S. N., Edwin H. Fitler, Charles L. Sharpless, Charles H. Rogers, Dr. Wm. R. Cruice.

March 7.—Wm. Harris Kneass, James H. Windrim, Crozer Griffith, Jesse W. Starr, Wm. L. Abbott, Robert Wood, Thomas S. Root, Howard Spencer, James Ridings, Jas. W. McAllister, Charles Wilt, Wm. S. Pine, John Meichel, Charles A. Blake, James H. Ridings, Geo. B. Dixon, Geo. Biddle, Horace F. Jayne, J. Sergeant Price.

March 28.—John Akhurst, Theo. L. Mead, Stuart Wood, Dr. John Eckfeldt, Edward Tatnall, Jr., Benj. H. Smith, James M. Rhodes, John T. Lewis, Jr., John S. Martin, Henry Pemberton, Charles W. Trotter, Charles Roberts, Edward K. Tryon, Edward Potts, Pierre Munzinger, Dr. Washington Hopkins Baker, Rathmell Wilson.

May 2.—William Nelson, Rev. Charles A. Dickey, Dr. Robert Hess, George A. Piersol, John Wister, Oliver Bradin, Dr. Wm. B. Brewster, Dr. J. Henry C. Simes, Pliny E. Chase.

June 6.—Dr. Chas. E. Slocum, Edward Taylor, Maxwell Sommerville, Henry M. Laing, William Wharton, Jr., C. H. Cramp, Charles H. Rogers, A. R. Justice, Mrs. Gertrude A. Quimby, J. S. Helfenstein, Thomas J. Audenreid, Edward P. Borden.

June 27.—John Russell, Isaac C. Martindale, Arthur Erwin Brown, Dr. A. C. Lambdin, Geo. A. Wright, Harvey Fisher.

July 25.—E. O. Thompson, Dr. Albert E. Foote.

September 26.—Dr. Isaac T. Coates.

October 31.—H. F. Whitman, Edwin A. Barber, Dr. W. H. Forwood, U. S. A.

November 28.—Walter H. Ashmead, Louis F. Benson.

CORRESPONDENTS.

March 7.—M. Alphonse Pinart, Paris; Edward T. Stevens, Salisbury, England.

March 28.—Baron Ferdinand von Mueller, of Melbourne, Australia; Prof. Austin Flint, M.D., of New York.

June 6.—Prof. Wentzel Gruber, of St. Petersburg, Russia.

July 25.—José de Saldanha da Gama, of Rio Janeiro; Dom Pedro II., Emperor of Brazil; Capt. Luiz de Saldanha da Gama, of the Imperial Brazilian Navy.

August 29.—Dr. S. H. Linn, of St. Petersburg, Russia; Prof. Paul Groth, of Strassburg; Dr. James Hector, of New Zealand.

September 26.—Don Alvaro de la Gándara, of Madrid, Spain; Col. Juan J. Marin, of Madrid, Spain; Signor Alessandro Castellani, of Rome.

October 31.—Col. W. L. Ludlow, Eng. Corps, U. S. A.

November 28.—Dr. A. S. Packard, Salem, Massachusetts; W. H. Holmes, U. S. Geol. Surv.; Prof. Laurenço Malheiro, of Lisbon, Portugal.

CORRESPONDENCE OF THE ACADEMY.

1876.

January.—H. M. Hull, in reference to donations from the Tasmanian Commission.

Societa Toscana di Scienza Naturali, Pisa, requesting exchanges and transmitting publications.

American Association for the Advancement of Science;

Astronomischen Gesellschaft, Leipzig;

Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne; severally acknowledging receipt of publications.

Senckenbergische Naturforschende Gesellschaft, Frankfurt a. M.;

Royal Academy of Amsterdam; severally acknowledging receipt of, and transmitting publications.

Belfast Museum;

Observatory of Madrid;

Naturforschende Gesellschaft zu Emden;

L'Academie Royale des Sciences Suedoise de Stockholm;

Geological Survey of India, Calcutta;

Kaiserliche Akademie der Wissenschaften in Wien;

Royal Meteorological Institute, Utrecht;

Naturwissenschaftliche Gesellschaft zu Chemnitz;

Aertzlichen Verein, Frankfurt;

Université Catholique de Louvain; severally transmitting publications.

February.—Naturhistorisches Verein in Augsburg;

Senckenbergische Naturforschende Gesellschaft; severally acknowledging receipt of, and transmitting publications.

Royal Society of Edinburgh, acknowledging receipt of publications.

Naturhistorisches Verein in Passau;

New York State Library;

Konigliche Norwegische Universität zu Christiania; severally transmitting publications.

Smithsonian Institution, thanking the Academy for the privilege of storing its plates.

University Observatory, Oxford, inviting contributions to the library.

Commission Geologique de l'Empire du Brésil.

University of Norway, notice of the death of Dr. Wm. Boeck.

March.—Société Hollandaise des Sciences, à Harlem;

Geological Survey of India, Calcutta;

Gesellschaft Naturforschende Freunde; severally transmitting publications.

Naturforschende Gesellschaft zu Freiberg, acknowledging receipt of publications.

Dr. Alfred Günther, acknowledging receipt of diploma.

Jas. P. Holmes, Minneapolis, Min., requesting names of members collecting plants with a view to exchange.

April.—Dr. A. Flint, Jr.;

F. T. Stevens, Esq., Salisbury, Eng.; severally acknowledging election as correspondents.

Gesellschaft zur Beförderung der gesammten Naturwissenschaften, Marburg; acknowledging receipt of, and transmitting publications.

A. J. Phillips, in reference to Mr. Jno. S. Phillips' bequest to the Academy.

Société Impériale des Naturalistes de Moscou, acknowledging receipt of publications.

Naturforschende Gesellschaft in Danzig.

Naturwissenschaftliche Verein für das Fürstenthum Lüneburg.

Mannheimer Verein für Naturkunde; severally transmitting publications.

May.—Archæological Society of Ohio, inviting the Academy to participate in the International Convention of Archæologists.

Smithsonian Institution;

Buffalo Society of Natural History;

Bergen Museum; severally acknowledging receipt of publications.

Sammlung für Kunst und Wissenschaft, Dresden, transmitting publications through the German Embassy at Washington.

Musée Teyler; à Harlem;

K. k. zoologisch-botanische Gesellschaft Vienna; severally acknowledging receipt of, and transmitting publications.

F. W. Hutton, acknowledging receipt of exchanges for Moa skeleton from Otago Museum.

Robt. J. Stevens, Clerk of the House of Representatives, in reference to a memorial to Congress by the Academy.

A. Bohatta, Vienna, in reference to a proposed device in telegraphy.

Jesse W. Starr, acknowledging election as a member.

June.—Kaiserliche Mineralogische Gesellschaft zu St. Petersburg;

Königliche Sachsische Gesellschaft, Leipzig; severally transmitting publications.

Canadian Institute;

New York Academy of Sciences;

Yale College Library; severally acknowledging receipt of publications.

Baron F. von Mueller, Melbourne, Australia, acknowledging election as correspondent.

Museum of Comparative Zoology, presenting a collection of fishes.

Lyceum of Natural History of New York, announcing change of name to New York Academy of Sciences.

Chas. E. Slocum, in reference to election as member.

J. T. Audenried, acknowledging election as a member.

July.—Joseph Menges, Frankfurt a. M., in reference to being sent on an expedition.

Boston Society of Natural History, acknowledging receipt of publications.

A. E. Brown, acknowledging election as a member.

Chas. H. Stubbs, M.D., in reference to models of stones marking Mason and Dixon's line.

August.—E. T. Stevens, Esq., presenting work on Stonehenge.

M. C. Cooke, in reference to publication of a paper in journal.

Zoological Society of Philadelphia, acknowledging the receipt of two green snakes.

Akademie Royale de Lisbonne;

University Library, Cambridge, Eng.;

Belfast Natural History and Philosophical Society;

Edinburgh Geological Society; severally acknowledging receipt of publications.

Belfast Naturalists' Field Club;

Verein zur Verbreitung Naturwissenschaftliche Kentniss in Wien; severally transmitting publications.

September.—Leyden Astronomical Observatory;

Academie Royale des Sciences des Lettres et des Beaux-Arts;

French Minister of Public Works at the Exposition;

Naturforschende Gesellschaft zu Emden; severally transmitting publications.

Royal Geological Society of Ireland;

K. Hof und Staatsbibliothek, Munich;

Naturforschende Gesellschaft zu Bamberg;

Statistical Society, London; severally acknowledging receipt of publications.

Mexican Commission at the Exposition, in reference to publications.

Jno. Hitz, Consul-General, Switzerland, in reference to donations from the Swiss Commission.

October.—La Société des Sciences de Finlande;

L'Academie Royale Suedoise des Sciences de Stockholm;

Schweizerische Gesellschaft für d. gasammten Naturwissenschaften, Bern;

Société Zoologique de France;

Die Naturforschende Gesellschaft in Berlin; severally transmitting publications.

Canadian Institute;

Yale College Library;

Musée Teyler, à Harlem; severally acknowledging receipt of publications.

Société Nationale des Sciences Naturelles de Cherbourg, in regard to exchanges.

Dr. Isaac Lea, giving duplicate copies of his works on conchology to the Academy.

Dr. Isaac Lea, accompanying specimens.

Dr. Isaac Lea, in reference to depositing a meteorite, with analysis of the same.

Prof. Wentzel Gruber:

Prof. Alphonse Pinart; severally acknowledging election as correspondents.

C. B. Dyer, in reference to the disposal of his collections.

November.—Societa Toscana di Scienza Naturali, Pisa, in regard to exchange of publications.

Prof. W. G. Farlow, Boston, asking for the loan of a specimen of Æcidium pyratum.

Leeds Philosophical and Literary Society, stating inability to supply deficiencies.

Museum of Comparative Zoology, Cambridge, transmitting photograph of Professor Agassiz.

E. A. Barber, acknowledging election as a member.

A. A. Outerbridge, in behalf of Mr. Gilbert, of Demarara, in regard to a collection of reptiles.

Dr. R. M. Bertolet, in reference to depositing a collection of stone implements.

December.—Señor Carvalho de Borges, Brazilian Minister, acknowledging receipt of letter announcing the election of Dom Pedro II. as a correspondent.

ADDITIONS TO THE LIBRARY 1876.

Adams, A. Leith. On a Fossil Saurian Vertebra (Arctosaurus Osborni), from the Arctic Regions. Dublin, 1875. The Author.

Adamson's Histoire Naturelle du Sénégal, 1757. J. S. Phillips.

Agardh, Jacobo Georgio. Species genera et ordinis Algarum. Vol. III. Wilson Fund.

Agassiz, L., large Photograph of. Alex. Agassiz.

Aguas Potable de Mexico. Prof. Alfonso Herrera.

Altum, Dr. Bernhard. Forstzoologie. I., II., and III. 1872–73. I. V. Williamson Fund.

Annual Report of the Librarian of Congress for the year 1875. The Author.

An Outline of Japanese Education, prepared for the Philadelphia International Exhibition 1876, by the Japanese Department of Education. 1876. The Japanese Commission.

Bailey, L. W. and Edw. Jack. The Woods and Minerals of New Brunswick. J. Laidlow.

Bancroft, H. H. The Native Races of the Pacific States of North America. Vol. V. New York, 1876. I. V. Williamson Fund.

Bárcena, Mariano. Noticia Geologica de una parte del Estado del Aquascalientes. Mexico, 1876. The Author.

Baxter, J. H. Statistics, Medical and Anthropological, of the Provost-Marshal-General's Bureau. 2 Vols. Washington, 1875. The Author.

Belleville, E. La Rage au Point de Vue Physiologique. The Author.

Bentham, Geo. et J. D. Hooker. Genera Plantarum. Vol. II. Pars II. Londini, 1876. I. V. Williamson Fund.

Bernardino de Souza, C. F. Pará e Amazonas pelo encarregado dos Trabalhos ethnographicos. 3a Parte. The Brazilian Centennial Commission.

Lembrancas e Curiosidades do Valle do Amazonas. The Brizilian Centennial Commission.

Bernstein, Julius. The Five Senses of Man. New York, 1876. I. V. Williamson Fund.

Berzelius, lithographic portrait of. Dr. J. Lindahl.

Bianconi, G. La Theorie Darwinienne et la Creation dite Indépendante. Review. The Author.

Billings, E. Palæozoic Fossils. Vol. I. and II. Part I. Geological Survey of Canada.

Binkerd, A. D. Mammoth Cave, Kentucky. Cincinnati, 1869. John A. Ryder.

Binney's Terrestrial Mollusca. 3 vols. 4to. J. S. Phillips.

Binney, W. G. Notes on American Land Shells. Vol. II. Part IV. The Author.

Blainville's Manuel de Malacologie. 2 vols. 1825. J. S. Phillips.

Blanchard, E. Les Insectes. Nos. 1–4. Paris, 1876. I. V. Williamson Fund.

Blanford, W. T. Eastern Persia. Vol. I. The Geography and Narratives by Majors St. John Lovett, and Euan Smith, and an Introduction by Major-General Sir Frederic John Goldsmid. Vol. II. Zoology and Geology. By W. T. Blandford. I. V. Williamson Fund.

Bleeker, P. Atlas Ichthyologique des Indes Orientales Néerlandaises. Livr. 28, 29, and 30. Wilson Fund.

Blytt's Norges Flora. Christiania, 1861–74. I. V. Williamson Fund.

Bock, H. H. Kreüter Buch. Strazburg, 1551. J. H. Redfield.

Bois-Reymond, Emil du. Gesammelte Abhandlungen zur allgemeinen Muskel- und Nervenphysik. 1er Band. I. V. Williamson Fund.

Bolton, H. Carrington. Index to the Literature of Manganese, 1596 to 1874. The Author.

Borre, A. Preudhomme de. La Possibilité de la Naturalisation de la Leptinotarsa decemlineata. The Author.

Bosanquet, R. H. M. On a new form of Polariscope. The Author.

Botelho de Magalhæs, B. C. Theoria das Quantidades Negativas. The Brazilian Centennial Commission.

Botella y de Hornos, D. F. de. Descripcion Geologica-Minera de las Provincias de Murcia y Albacete. Madrid, 1860. The Geological Survey of Spain.

Boucard, Adolphe. Monographic List of the Coleoptera of the Genus Plusiotis of America, North of Panama.

Notes sur quelques Trochilidés.

Notes sur les Trochilidés du Mexique.

Catalogus Avium hucusque descriptorum. Londini, 1876. The Author.

Bouvier, A. Afrique Occidentale. Catalogue Geographique des Oiseaux. Paris, 1875. The Author.

Bowerbank, J. S. A Monograph of the British Spongiadæ. Vols. I., II., and III. I. V. Williamson Fund.

Bradley, F. H. Geological Chart of the United States. The Author.

Brandegee, T. S. The Flora of Southwestern Colorado. The Author.

Brauns, Dr. D. Der mittlere Jura in nordwestlichen Deutschland. Cassel, 1869. I. V. Williamson Fund.

Brazil. The Empire of Brazil at the Universal Exhibition of 1876, in Philadelphia. The Brazilian Commission.

Breve Noticia sobre a Provincia do Maranhao. The Brazilian Centennial Commission.

Brewer, W. H., Senero Watson, and Asa Gray. Geol. Surv. Cal. Botany. Vol. I. Polypetalæ and Gamopetalæ. Cambridge, 1876. I. V. Williamson Fund.

Brewster, Wm. Some Additional Light on the so-called Sterna Portlandica, Ridgway. The Author.

Briosi, Prof. Giovanni. Sulla Phytoptosi della Vita. Palermo, 1876. The Author.

Broun, H. G. Klassen und Ordnungen des Thier-Reichs, 6er Band I. Abth. 1 Lief. II. Abth. 8, 9, 12, and 13 Lief. V. Abth. 11 and 12 Lief. 7er Band V. Abtheil 9 and 10 Lief. Wilson Fund.

Brown, Robert. The Races of Mankind. Four vols. in two. I. V. Williamson Fund.

Brühl, C. B. Zootomie aller Thierklassen. Atlas, Lief. 4 and 5. Wien. I. V. Williamson Fund.

Brusina, Spiridione. Secondo Saggio dalla Malacologia Adriatica.

Fossile Binnen-Mollusken aus Dalmatien, Kroatien und Slavonien.

Contribuzione pella Fauna dei Molluschi Dalmati.

Contribution a la Malacologie de la Croatie. The Author.

Bruylants, Gustave. Recherches sur les Hydrocarbures. Catholic University of Louvain.

Büchner, Dr. L. A. Uber die Beziehungen der Chemie zur Rechtspflege, 1875. The Author.

Buckley, S. B. Second Annual Report of the Geological and Agricultural Survey of Texas. The Author.

Buonanni, Recreatione dell' Occhio, 1681. J. S. Phillips.

Bursian, Dr. Conrad. Über den religiosen Charakter des griechischen Mythos, 1875. The Author.

Button, F. T. List of the California Land and Marine Shells for exchange. Oakland, Cal. The Author.

Canimhoa, L. Relatorio sobre Zootechnia. The Brazilian Centennial Commission.

Capron, Horace. Reports and Official Letters to the Kaitakushi, by Horace Capron and his Foreign Assistants. Tokei, 1875. K. Kuroda.

Carpenter, Horace F. A Catalogue of the Shell Bearing Mollusca of Rhode Island. The Author.

Carpenter, Wm. B. Introduction to the Study of the Foraminifera. By Wm. B. Carpenter, assisted by Wm. K. Parker and T. Rupert Jones, I. V. Williamson Fund.

Castro, Don Manuel Fernandez de. Ætobatis Poeyii. Madrid, 1873. The Author.

Catalogue delle Conchiglie componenti la Collezione Pigacci. Parte prima della Conchiglie vicenti. Roma, 1866. T. A. Conrad.

Catalogue of H. C. Roeters van Lennep's Collection of Shells, 1876. The Publishers.

Catalogue of the West Virginia State Exhibit. W. Virginia Centennial Commission.

Catalogue of the Chinese Imperial Maritime Customs Collection. Chinese Centennial Commission.

Catalogue of the Austrian Department, Philadelphia Centennial Exhibition of 1876. The Commission.

Catalogue of recently added books, Library of Congress, 1873–75. The Librarian.

Catlow's Conchologist Nomenclator. Interleaved. 1845. J. S. Phillips.

Census of the Town of Madras, 1871. Madras, 1873. The Indian Government.

Centennial Exhibition, Philadelphia, 1876. Dominion of Canada, Province of Ontario. Catalogue of Exhibits in Education Department, 1876. J. Laidlaw.

Educational Institutions. Province of Ontario. J. Laidlaw.

Chemins de Fer de la Province de St. Paul. Brézil, 1875. Brazilian Centennial Commission.

Clark, S. F. The Hydroids of the Pacific Coast of the United States, south of Vancouver Island. The Author.

Clark, W. B. Mines and Mineral Statistics of New South Wales. N. S. Wales Centennial Commission.

Cole, Jas. E. The Mechanical Construction of Water. New York, 1876. The Author.

Conrad's New Fresh Water Shells. John S. Phillips.

Conrad's Unionidæ. Vol. I. J. S. Phillips.

Conrad's American Marine Conchology, 1831. J. S. Phillips.

Conrad's Tertiary Fossils. J. S. Phillips.

Cooke, M. C. Mycographia seu Icones Fungorum. Part I. Wilson Fund.

Cope, Edw. D. Article on Osteology.

Descriptions of some vertebrate Remains from the Fort Union Beds of Montana. The Author.

On the supposed Carnivora of the Eocene of the Rocky Mountains. The Author.

Cortazar, Daniel de. Memorias de la Comision del Mapa Geologico de España. Descripcion de la Provincia de Cuença. Madrid, 1875. The Author.

Descripcion fisica, geológica y Agrológica de la Provincia de Cuença. The Geol. Survey of Spain.

Cotton Manufacture in the United States. J. S. Phillips.

Coutinho, J. M. da Silva. O Cacáo na Exposicao universal de 1867. The Brazilian Centennial Commission.

Cox, E. T. Seventh Annual Report of the Geological Survey of Indiana, made during the year 1875. Indianapolis, 1876. G. M. Levette.

Cozzen's Geology of New York, 1843. J. S. Phillips.

Crépin, François. Materiaux pour servir a l'Histoire des Roses. Troisième Fasc. Gand, 1874–75. The Author.

Croft, Thomas. The Self-Propagating Nature of Centrifugal Force. Papeete, 1875. The Author.

Crosby, W. O. Report on the Geological Map of Massachusetts. Boston, 1876. The Author.

Cuences Carbonifer de Asturias. Geol. Surv. of Spain.

Curioser Botanicus, oder Sonderbahres Kräuterbuch. Dresden and Lipzig, 1745. Louis Godey through C. F. Parker.

Cuvier's Regne Animal. Twelve Numbers of Fishes and Mollusks. 3 Vols. Mollusks and 2 Vols. Zoophytes. J. S. Phillips.

Cuvier's Leçons d'Anatomie Comparée. 2d Ed. 1837. J. S. Phillips.

Cyon, E. Methodik der Physiologischen Experimente und Vivisectionen. 1 Vol. and atlas. I. V. Williamson Fund.

DaCosta's Elements of Conchology. 1776. J. S. Phillips.

Dale, T. Nelson. A Study of the Rhaetic Strata of the Val di Ledro in the Southern Tyrol. 1876. The Author.

Dana, Jas. D. Cephalization. Part V. The Author.

Davila's Catalogue. Vol. I. J. S. Phillips.

Dawson, Geo. M. Report on the Geology and Resources of the Region in the vicinity of the 49th Parallel. Montreal, 1875. Geol. Surv. of Canada.

Dawson, J. W. The Fossil Plants of the Devonian and Upper Silurian Formations of Canada. 1871. Geol. Survey of Canada.

Report on the Fossil Plants of the Lower Carboniferous and Millstone Grit Formations of Canada.

Figures and Descriptions of Canadian Organic Remains. Decades 2 to 4. Geol. Survey of Canada.

Descriptive Notices of the Models, Maps, and Drawings collected under the Auspices of the Ministry of Public Works. M. Lavoinne.

Descriptive Catalogue of a collection of the Economic Minerals of Canada. J. Laidlow.

Detailed Census Returns of the Bombay Presidency. Part III. Bombay, 1874. Indian Government.

Die Industrie des Königreichs Würtemberg. Prag, 1873. The Author.

Dillwyn's Catalogue of Shells. Vols. 1 and 2. J. S. Phillips.

Donayre, D. Felipe Martin. Bosquejo de una Descripcion fisica y geologica de la Provincia de Zaragoza. The Geological Survey of Spain.

Douglass, J. W. and John Scott. The British Hemiptera. Vol. 1. Hemiptera-Heteroptera. I. V. Williamson Fund.

Drechsler, A. Der Arabische Himmels—Globus. Katalog der Sammlung des K. mathem-phys. Salons zu Dresden. Royal Museum at Dresden.

Dunker und Zittel, Drs. Palæontographica; 21er Band, 7e and 8e Lief.; 22er Band, 7e Lief.; 23er Band, 8e and 9e Lief.; 24er Band, 2e and 3e Lief. and General Register, 1es Heft. Cassel, 1876. Wilson Fund.

Ecole des Ponts et Chaussées. Cours Preparatoires;
Élèves Externes;
Catalogue des Livres composant la Bibliothèque;
Catalogue des Modèlles, Instruments, &c.;
Collection de Dessins;
Programmes de l'enseignement interieur. From M. Lavoinne.

Edwards, A. Mead. The Microscope in Gynæcology. Newark, 1875. The Author, through Biol. and Micr. Section.

Emerson, Geo. B. A Report on the Trees and Shrubs growing naturally in the Forests of Massachusetts. Vols. 1 and 2. Second Edition. Boston, 1875. I. V. Williamson Fund.

Encyclopedia Methodique. Mollusca. Vols. 1 and 2. J. S. Phillips.

Encyclopedia Britannica. Vols. III. and IV. I. V. Williamson Fund.

Engelmann, Geo. Notes on Agave.
The Oaks of the United States. The Author.

Erlenmeyer, Dr. E. Ueber den Einfluss des Freihern Justus von Liebig auf die Entwicklung der reinen Chemie. The Author.

Esper's Pflanzenthiere. 1791. J. S. Phillips.

Faber, Carl. Der Bau der Iris. Leipzig, 1876. I. V. Williamson Fund.

Falkenberg, Dr. P. Vergleichende Untersuchungen über den Bau der Vegetationsorgane der Monocotyledonen. Stuttgart, 1876. I. V. Williamson Fund.

Featherstonhaugh, G. W. Geological Report of an examination made in 1834 of the elevated Country between the Missouri and Red Rivers. 8vo. Washington, 1835. I. V. Williamson Fund.

Ferussac's Histoire Naturelle des Mollusques. 5 Vols. Folio. J. S. Phillips.

Fialho, Anfriso. Don Pedro II. Empéreur du Brésil. Notice Biographique. Bruxelles, 1876. The Brazilian Centennial Commission.

Figuier, Louis. The Human Race. New York, 1872. Geo. W. Tyron, Jr.

Fischer, M., et H. Crosse. Mission Scientifique au Mexique et dans l'Amérique Centrale. Recherches Zoologique, 7me Partie. Etudes sur les Mollusques terrestres et fluviatiles. Paris, 1875. The Authors.

Fitzinger, L. J. Der Hund und seine Racen. 1e, 2e, and 3e Lief. Tübingen, 1876. I. V. Williamson Fund.

Fleming's History of British Animals. 1842. J. S. Phillips.

Foote, A. E. The Naturalist's Agency Catalogue. Part First. Minerals. The Author.

Freiesleben, J. C. Geognostischer Beytrag. 4 Volumes in Three. Freyberg, 1807. I. V. Williamson Fund.

Fries, E. Icones Selectæ Hymenomycetum Hungariæ. II. and III. Hungarian Academy of Sciences.

Fromentel, E. Études sur les Microzoaires. 3me Fasc. Paris. I. V. Williamson Fund.

Galvani, L. Collezione delle Opere. 2 Vols. 4to. From Acad. of Sciences of the Inst. of Bologna.

Gastinet, Mr. Memoria sobre a cultura do Cafezeiro no Yemen. The Brazilian Centennial Commission.

Geinitz, H. B. Die Urnenfelder von Strehlen und Grossenhain. Royal Museum at Dresden.

Geinitz und Marck, Drs. Zur Geologie von Sumatra. Royal Museum at Dresden.

Geol. Surv. of Canada. Report of Progress 1866 to 1875. 6 vols.
Gentry, T. G. Life-Histoiries of the Birds of Eastern Pennsylvania. Vol. I. Phila. 1876. The Author.
Gervais, Paul. Zoologie et Paléontologie Générales. 2me Série. Livr's 14, 15 and 16. Paris, 1876. Wilson Fund.
Giebel, C. G. Thesaurus Ornithologiæ. 5er Halbband. Leipzig, 1876. I. V. Williamson Fund.
Gill, Theo. Arrangements of the Families of Mammals, Fishes, and Molluska. 3 copies of each. Smithsonian Institution.
Gillmore, Parker. Prairie and Forest: a description of the Game of North America. London, 1874. I. V. Williamson Fund.
Giudice, F. del. Dell Instituzione de Pompieri.
Universalita dei Mezzi di Previdenza, difesa e salvezza per la Calamita degl' Incendi. Academy of Bologna.
Goode, G. Brown. Classification of the Collection to illustrate the Animal Resources of the United States. Washington, 1876. The Author.
Gould's Report on the Invertebrata of Massachusetts. J. S. Phillips.
Gould, John. A Monograph of the Trogonidæ. Parts III. and IV. London, 1875. Wilson Fund.
The Birds of Asia. Parts 26 and 27. London, 1875. Wilson Fund.
The Birds of New Guinea and the adjacent Papuan Islands, including any new species that may be discovered in Australia. Parts 1 and 2. London, 1875-76. Wilson Fund.
Gray's Conchology of the Voyage of the Blossom. J. S. Phillips.
Greenhow's Oregon and California. 2d Ed. 1845. J. S. Phillips.
Grote, A. R. Check List of the Noctuidæ of America, North of Mexico. I. Bombyciæ and Noctuelitæ (Nonfasciatæ). Buffalo, 1875. The Author.
Gruber, Dr. Wenzel. Monographie über das Corpusculum triticeum. St. Petersburg, 1876. The Author.
Gumaelius, Otto. Om Malmgrens Aldersföljd och deras Användande såsom ledlager. Geol. Surv. of Sweden.
Gunther, Albert. Description of the Living and Extinct Races of Gigantic Land Tortoises. Parts I. and II.
Contribution to the Anatomy of Hatteria (Rhynchocephalus, Owen).
Description of Ceratodus. The Author.
Gurney, J. H. Rambles of a Naturalist in Egypt and other Countries. London. Mrs. E. P. Gurney.
Guthrie's Universal Geography. London, 1795. J. S. Phillips.
Haeckel, Ernst. Die Perigenesis der Plastidule. Berlin, 1876. I. V. Williamson Fund.
History of Creation. Vols. 1 and 2. I. V. Williamson Fund.
Ziele und Wege der heutigen Entwickelungsgeschichte. Jena, 1875. I. V. Williamson Fund.
Arabische Korallen. Berlin, 1876. I. V. Williamson Fund.
Haldeman's Fresh Water Univalve Mollusca. 2 Vols. 1842. J. S. Phillips.
Half Hours with Modern Scientists. Second Series. New Haven, 1873. John A. Ryder.
Hall, Chas E. On Glacial Deposits in West Philadelphia. The Author.
Hanley, Sylvanus and Wm. Theobald. Conchologia Indica. Part 8. London. Wilson Fund.
Hanley's Young Conchologist. 1840. J. S. Phillips.
Harcus, Wm. South Australia: its history, resources, and productions. London, 1876. Samuel Davenport.
Same. Lorin Davenport.

Hartley, Walter Noel. Air in its relations to Life. I. V. Williamson Fund.

Hartmann, Dr. Robt. Die Nigritier. 1er Theil. Berlin, 1876. I. V. Williamson Fund.

Haughton, Rev. Samuel. On the Tides of the Arctic Seas. The Author.

Hayden, F. V. Report of the United States Geological Survey of the Territories. Vols. IX. and X. Department of Interior.

Another Copy of Vol. IX. F. V. Hayden.

Annual Report of the United States Geological and Geographical Survey of the Territories for 1874–1876. Department of the Interior.

Hector, Jas. Geological Sketch. Map of New Zealand. The Author.

Heer, Oswald. Flora Fossilis Helvetiæ. 1e Lief. Die Steinkohlenflora. Zurich, 1876. I. V. Williamson Fund.

Hemsley, U. B. Handbook of Hardy Trees, Shrubs, and Herbaceous Plants. 1873. I. V. Williamson Fund.

Hess, W. Bilder aus dem Aquarium. I. V. Williamson Fund.

Heude, R. P. Conchyliologie Fluviatile de la Province de Nanking. Fasc. 1. I. V. Williamson Fund.

Hewitson, Wm. C. Illustrations of Diurnal Lepidoptera. Parts IV. and VI. Lycenidæ. Wilson Fund.

Exotic Butterflies. Part 97, 98, and 99. London. Wilson Fund.

Hidalgo, J. G. Moluscos Marinos de España, Portugal y las Baleares.

Catalogo iconografico y descriptivo de los Moluscos, Terrestres de España, Portugal y las Baleares.

Moluscos del Viaje al Pacifico verificado de 1862 a 1865 por una comision de Naturalistas enviada por el Gobierno Español. Parte 1ra.

Univalvos Terrestres. Madrid, 1869. The Author.

Higgins, Henry H. Synopsis of an arrangement of Invertebrate Animals in the Free Public Museum of Liverpool, with Introduction. 1874. The Author.

Higgins, Thos. Sponges: their Anatomy, Physiology, and Classification. H. H. Higgins.

Hofmann, Karl B. Lehrbuch der Zoochemie. 1es Heft. Wien, 1876. Wilson Fund.

Hooker, J. D. The Flora of British India. Part IV. London. The Author.

Hooker, Sir Wm. Jackson, and John G. Baker. Synopsis Filicum. London, 1868. J. H. Redfield.

Houston, Edwin J. The Elements of Physical Geography, for the use of Schools, Academies, and Colleges. Philadelphia, 1876. The Author.

Hoysradt, Lyman H. Catalogue of the Phænogamous and Acrogenous Plants, growing without cultivation within five miles of Pine Plains, Duchess Co., N. Y. Torrey Botanical Club.

Hugo, M. le Comte Leopold. Extraits de deux lettres addressées a D. B. Boncompagni. The Author.

Hugo, Leopold. Astronomie géométrique. The Author.

Hummel, David. Sveriges Geologiska Undersökning Nos. 54, 55, 56. Om Sveriges Lagrade uberg jemförda med Sydvestra Europas. With Maps. Geol. Surv. of Sweden.

Hunt, T. Sterry. Chemical and Geological Essays. Boston, 1875. I. V. Williamson Fund.

Hutton, F. W., and G. H. F. Ulrich. Report on the Geology and Gold Fields of Otago. Dunedin, 1875. The Author.

Huxley, T. H. The Oceanic Hydrozoa. I. V. Williamson Fund.

Icones Fossilium Sectiles. Pp. 1–4, and Plates I.–XIX. Mr. Davis of the British Museum.

Ingersoll, Ernest. Special Report on the Recent Mollusca of Colorado. Department of Interior.

Jackson, W. H. Photographs of the Principal points of interest in Colorado, Wyoming, Utah, Idaho, and Montana. From Negatives taken in 1869, '70, '71, '72, '73, '74, '75. Folio. 1876. Dr. F. V. Hayden.

Jan, Prof. Iconographie générale des Ophidiens. 47me Livr. Wilson Fund.

Jay's Catalogue of Shells. 3d ed. 1839. Same, 4th ed. 1850. J. S. Phillips.

Jeffreys, J. Gwyn. On some new and remarkable North Atlantic Brachiopoda. Geo. W. Tryon, Jr.

Jenney, Walter P. The Mineral Wealth, Climate, and Rain-fall, and Natural Resources of the Black Hills of Dakota. Department of Interior.

Johnson's New Universal Cyclopedia. Vols. II. and III. I. V. Williamson Fund.

Jolis, Auguste C. De la Rédaction des Flores locales au point de vue de la geographie botanique. The Author.

Jordan, David Starr. Manual of Vertebrata of the Northern United States. Chicago, 1876. I. V. Williamson Fund.

José de Franca, Bacharel Joaquin. Relatorio sobre a Pintura e Estatuaria. The Brazilian Centennial Commission.

Kerr, W. C. Report of the Geological Survey of North Carolina. Vol. I. 1875. The Author.

Kidder, J. H. Contributions to the Natural History of Kergulen Island. II. Washington, 1876. The Author.

Kiener's Species Général et Iconographie des Coquilles Vivantes. 8 vols. J. S. Phillips.

King, Clarence, and J. D. Hague. U. S. Geol. Explor. of the 40th Parallel. Mining Industry, by James D. Hague. With Geological Contributions, by Clarence King. Washington, 1870. 1 vol. 4to. and folio atlas. Eng. Dept. U. S. A.

Klein's Echinodermatum. Gedani, 1734. J. S. Phillips.

Knauer, F. K. Fang der Amphibien und Reptilien und deren Conservirung für Schulzwecke. Wien, 1875. I. V. Williamson Fund.

Beobachtungen an Reptilien und Amphibien in der Gefangenschaft. Wien, 1875. I. V. Williamson Fund.

Amphibien und Reptilienzucht. Wien, 1875. I. V. Williamson Fund.

Kobelt, Dr. W. Rossmässler's Iconographie der Europäischen Land und Susswasser-Mollusken. IV. Band, 2–4 Lief. Wilson Fund.

Koebler, August. Practical Botany. New York, 1876. The Author.

Koksharow, Nikolai v. Materialien zur Mineralogie Russlands. Vol. VI. pp. 345, to VII. 224. Atlas plates 83–87. I. V. Williamson Fund.

Kölliker, Albert. Entwickelungsgeschichte des Menschen und der Höheren Thiere. Zweite Auflage, 1e Hälfte. Leipzig, 1876. I. V. Williamson Fund.

Kramer, Franz. Phanerogamen Flora von Chemnitz und Ungegend. 1875. The Author.

Kuster, H. C. Systematisches Conchylien Cabinet von Martini und Chemnitz. 1er Band, Heft 81; 2er Band, Heft 20; 3er Band, Heft 37; 4er Band, Heft 18, 19, and 20; 9er Band, Heft 31; 248e, 249e, 250e, 251e, and 252e Lief. Nurnberg, 1876. Wilson Fund.

Lacordaire and Chapuis. Collection des Suites a Buffon. Insectes Coléoptères. Tome XII. Planches, 13 Livr. Wilson Fund.

Lamarck's Animaux sans Vertèbres. 2me ed., tome 5me, 8me, 1838. Same. 3me ed., tome 3me. 1844. J. S. Phillips.

Lamarck's Species of Shells, 1843. J. S. Phillips.

Lanza, Dr. Fr. Elementi di Mineralogia accompagnati da pratiche applicazione economiche industriali per uso dei iunaisi e delle scuole reali. 3d ed. Trieste, 1864. The Author.

Viaggio in Inghilterra e nella Scozia. Trieste, 1860. The Author.

Il progresso industriale Agronomico del Secolo applicato ai bisogni patri con illustrazioni intercalate nel testo per il Prof. Dr. F. Lanza de Casalanza. Trieste, 1870. The Author.

Dell' Antico Palazzo di Diocleziana in Spalato. Trieste, 1865. The Author.

Law, James. Principes de l'élevage des Animaux domestiques. The Author.

Lawrence, Geo. N. Descriptions of Five New Species of American Birds.

Description of a New Species of Jay of the Genus Cyanocitta; also of a supposed New Species of the Genus Cyanocorax.

Descriptions of four New Species of Birds from Costa Rica.

Descriptions of two New Species of Birds of the Families Tanagridæ and Tyrannidæ. The Author.

Lea, Isaac. A Catalogue of the published Works of Isaac Lea, LL.D.

Further Notes on Inclusions in Gems, etc. The Author.

Lea's Contributions to Geology. J. S. Phillips.

Naiades, etc., from Philosophical Transactions. 1 vol. 4to. J. S. Phillips.

Leakin, Geo. A. The Periodic Law. 12mo. New York, 1868. The Author.

Le Maout, Emm, and J. Decaisne. A General System of Botany. Translated and arranged by Mrs. Hooker and J. D. Hooker. London, 1876. I. V. Williamson Fund.

Les Voyages d'Etudes autour du Monde. Paris, 1876. The Author.

Lesley, J. P. Second Geological Survey of Pennsylvania, 1874, '75, '76. Reports A, C, K, M, D, and I. The Commissioners.

Letourneau, Chas. Bibliothèque des Sciences Contemporaines. La Biologie. Paris, 1876. I. V. Williamson Fund.

Linnæus, lithographic portrait of. Dr. J. Lindahl.

Little, Geo., 1st and 2d Reports of Progress of the Mineralogical, Geological, and Physical Survey of the State of Georgia, 1874–75. The Author.

Lockyer, J. Norman, and W. Chandler Roberts. On the Quantitative Analysis of Certain Alloys by means of the Spectroscope. The Author.

Lommel, Dr. Eugene. The Nature of Light. New York, 1876. I. V. Williamson Fund.

Lowe, Richard Thomas. A Manual of the Flora of Madeira. London, 1868. I. V. Williamson Fund.

Lucas, M. Felix. Étude Historique et Statistique sur les Voies de Communication de la France. Paris, 1873. M. Lavoinne.

Mackay, Angus. The Native Grasses. The Author.

Maestre, Don Amalio. Descripcion Geologica industrial de la Cuenca Carbonifera de San Juan de las Abadessas en la Provincia de Gerona.

Descripcion fisica y geologica de la Provincia de Santander. The Geological Survey of Spain.

Malezieux, M. Note sur les Élèves externes de l'École des Ponts et Chaussées. M. Lavoinne.

Marrat, F. P. On the Variations of Sculpture exhibited in the Genus Nassa. George W. Tryon, Jr.
Mastodon, four photographs of limbs and teeth of. C. W. Williamson.
Materials for the Geology of Russia. Vols. 1–5. 1869–73. St. Petersburg.
Marsh, O. C. Notice of a new Sub-Order of Pterosauria. Notice of a new Odontornithes. The Author.
Principal Characters of the Dinocerata. Part I. The Author.
Principal Characters of the Brontotheridæ. On some Characters of the genus Coryphodon, Owen. The Author.
Maury, W. F., and Wm. M. Fontaine. Resources of West Virginia. W. Virginia Centennial Commission.
McQuillen, J. H. Einfluss von Temperatur-Wechsel und Feuchtigkeit auf die Zähne.
Ueber die Parasiten in der Mundhöhle und in den Zähnen.
Ein Beitrag zur Chirurgie. The Author.
Introductory Lecture to the Winter Course of the Philadelphia Dental College, Session 1875–76. 1876. The Author.
Eröffnungs-Rede zum Winter-Semestre, 1875–76, am Philadelphia Dental College. The Author.
Meehan, Thos. Are Insects any Material Aid to Plants in Fertilization? The Author.
Meinicke, Dr. Carl E. Die Inseln des Stillen Oceans. 2er Theil. Leipzig. 1876. I. V. Williamson Fund.
Menke's Synopsis Molluscorum. 1828. J. S. Phillips.
Metric System of Weights and Measures. The Authors.
Michigan. The State of Michigan.
Catalogue of the Products of Michigan.
Chart and Key of the Educational System of Michigan. Michigan Centennial Commission.
Middendorff, Dr. A. v. Sibirische Reise. Band IV., 2r Theil. St. Petersburg. 1875. Wilson Fund.
Miller, Phillip. The Second volume of the Gardener's Dictionary. 2d ed. London, 1740. Isaac Burk.
Milne Edwards, M. Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux. Tome II, 2e Partie. 1875. Wilson Fund.
Mitchell's New General Atlas, 1876. I. V. Williamson Fund.
Miscellaneous Pamphlets. Incomplete Volumes of Periodicals, etc. J. S. Phillips.
Miscellaneous Publications of the U. S. Geol. and Geogr. Surv. of Territories, No. 4. F. V. Hayden.
Mivart, St. George. Lessons from Nature, as manifested in Mind and Matter. New York, 1876. I. V. Williamson Fund.
Mollusca of the Voyage of the Sulphur. J. S. Phillips.
Montagu's Testacea Britannica, 1803. J. S. Phillips.
Monterosato, Msc. Di. Notizie intorno ai Solarii del Mediterranea.
Poche Note sulla Conchiglie Mediterranea.
Notizie intorno alle Conchiglie fossile di Monte Pellegrino e Ficarozzi.
Nuova revista della Conchiglie Mediterranea. The Author, through John B. King.
Moreira, Nicolau J. Brazilian Coffee.
Historical Notes concerning vegetable fibres. From Brazilian Centennial Commission.
Morelet's Mollusques du Portugal, 1845. J. S. Phillips.
Morton's Cretaceous Fossils of the United States. J. S. Phillips.
Mueller's Synopsis Testaceorum. J. S. Phillips.

Mueller, Ferdinandus de. Fragmenta Phytographiæ Australiæ. Vols. 7, 8, 9. Melbourne, 1869–75. The Author.

Same. Parts 5 to 10. I. V. Williamson Fund.

Müller, Albert. Ueber das Auftreten der Wanderheuschrecke am des Bielersee's. The Author.

Murray, Andrew. The Pines and Firs of Japan. London, 1863. I. V. Williamson Fund.

Netto, Dr. Ladislau. Investigaçoes historicas e scientificas sobre o Museo Imperial e Nacional de Rio de Janeiro. The Brazilian Centennial Commission.

Neville, G. & H. Descriptions of new Marine Mollusca, from the Indian Ocean. The Authors.

Newberry, J. S. Report of the Exploring Expedition from Sante Fé, N. M., to the junction of the Grand and Green Rivers of the Great Colorado of the West in 1859. With Geological Report. Washington, 1876. Eng. Dep., U. S. A.

Anothor copy. The Author.

Report of the Geological Survey of Ohio. Vols. II. Geology and Palæontology. Part II. Palæontology. Columbus, 1875. J. S. Newberry.

The Structure and Relations of Dinichthys. Columbus, 1875. The Author.

Newcomb, Simon. Reports of Observations on the Total Eclipse of the Sun, Aug. 7, 1869.

An Investigation of the Orbit of Uranus. Dr. F. A. Hassler.

New South Wales. Mineral Map and General Statistics of New South Wales.

New South Wales, its progress and resources.

Official Catalogue of the natural and industrial products of New South Wales, forwarded to the International Exhibition of 1876 at Philadelphia. N. S. Wales Centennial Commission.

Notes on Portugal. By E. A. G. W. C. Stevenson.

On the Forms and Structure of the Atoms and Molecules of Bodies. The Author.

Orsoni, Francesco. Ricerche Elettro-Dinamische. Noto, 1876. The Author.

Orton, James. Comparative Zoology. I. V. Williamson Fund.

Owen's Extinct Gigantic Sloth. 1842. J. S. Phillips.

Pabst, G. Cryptogamen Flora Flechten und Pilze. I. V. Williamson Fund.

Packard, A. S. Our Common Insects. I. V. Williamson Fund.

Monograph of the Geometrid Moths. F. V. Hayden.

Paléontologie Française. 2d Série. Végétaux. Terrain Jurassique. Livr. 20–21. Wilson Fund.

Paraná, 1875. The Brazilian Centennial Commission.

Parkinson's Organic Remains. 3 Vols. 4to. J. S. Phillips.

Peale, Franklin. Specimens of the Stone Age of the Human Race. Philadelphia, 1873. Titian R. Peale.

Penna, D. S. F. Noticia geral das comarcas de Gurupáemacapá. The Brazilian Centennial Commission.

Pfaff, Friedrich. Die Theorie Darwin's und die Thatsachen der Geologie. Frankfurt-am-Main, 1876. Wilson Fund.

Pfeiffer, L. Symbolæ ad Historiam Pelicorum. 1841. J. S. Phillips.

Novitates conchologicæ. 48 and 49 Lief. Cassel. Wilson Fund.

Monographia Heliceorum viventium. Vol. 7. Fasc. III. and IV., 1875. Vol. 8, Fasc. I. and II., 1876. Lipsæ. Wilson Fund.

Monographia Pneumonoporum Viventium. Supplementum Tertium. Fasc. I., altera. Cassellis, 1875. Wilson Fund.

Philadelphia Centennial Exhibition. 1876. Victoria, Australia. Official Catalogue of Exhibits, Essays, etc. Melbourne, 1876. J. H. Ryder.

Philippi's Abbildungen und Beschreibungen neuer oder wenig gekeunter Conchylien. 1er Band. 1845. J. S. Phillips.

Photograph of prepared Indian Head. Chas. S. Rand.

Pickering, Chas. The Geographical Distribution of Animals and Plants. Part II. Plants in their Wild State. 1876. The Author.

Pisani, M. F. Traité élémentaire de Mineralogie. Paris, 1875. Wm. S. Vaux.

Platt, Franklin. Second Geol. Surv. of Pennsylvania. Report of Progress in the Clearfield and Jefferson District of the Bituminous Coal Fields of Western Pennsylvania. 1875. The Commission.

Poey, Don Felipe. Enumeratio Piscium Cubensium. The Author.

Powell, J. W. Dep. of Int. U. S. Geol. and Geog. Surv. of the Territories. 2d Div. Report on the Geology of the Eastern Portion of the Uinta Mountains and region of country adjacent thereto. With Atlas. The Author.

Prado, Don Casiano de. Descripcion fisica y geologica de la Provincia de Madrid. The Geological Survey of Spain.

Prantl, Dr. K. Untersuchungen zur Morphologie der Gefässkryptogamen. 1 Heft. Die Hymenophyllaceen. Leipzig, 1875. I. V. Williamson Fund.

Raddius, Josephus. Plantarum Brasiliensium Nova Genera et Species Novæ, vel minus cognitæ. Florentiæ, 1825. J. H. Redfield.

Rafinesque's Shells of the River Ohio, 1832. 2 copies. J. S. Phillips.

Ramsay, E. Purson. Catalogue of the Australian Accipitres. Sydney, 1876. The Author.

Rang's Manuel. 12mo. Atlas, 1829. J. S. Phillips.

Rauber, A. Ueber die Stellung des Hühnchens im Entwicklungsplan. Leipzig, 1876. I. V. Williamson Fund.

Rau, Chas. Early Man in Europe. New York, 1876. I. V. Williamson Fund.

Reeve, Lovell. Conchologia Iconica. Part 324–329. Wilson Fund.

Regel, E. Alliorum adhuc cognitorum Monographia. I. V. Williamson Fund.

Reglement du College Sadika. Tunis, 1875. J. B. King.

Relham, Richardi, Flora Cantabrigiensis. Editio Tertia. 1820. John E. Cook.

Report of the Commission to Investigate Affairs at the Red Cloud Indian Agency, 1875. From the Department of the Interior.

Reports on the Meteorological, Magnetic, and other Observations of the Dominion of Canada, 1875. The Meteorological Office.

Reuisch, P. F. Contributiones ad Algologiam et Fungologiam. Vol. I. Lipsiæ, 1875. I. V. Williamson Fund.

Riley, C. V. Notes on the Yucca Borer. St. Louis. 1876. The Author.

Rio, Dr. Martinez del. El ilustre Doctre Louis. Noticia Biografica. The Author.

Robinson, Chas. New South Wales; the oldest and richest of the Australian Colonies. N. S. Wales Centennial Commission.

Roehl, E. von. Fossile Flora der Steinkohlen-Formation Westphalens. Cassel, 1869. I. V. Williamson Fund.

Rolleston, Geo. Address to the Department of Anthropology (Biological Section) of the British Association. On the People of the Long Barrow Period. The Author.

Rominger, C. Geol. Surv. of Michigan. Palæontology, Fossil Corals. New York, 1876. The Author.

Rossmässler's Iconographie der Europäischen Land und Süsswasser Mollusken. IV. Band, 1e Lief. Wiesbaden, 1875. Wilson Fund.

Iconographie der Land und Susswasser Mollusken, 1835. J. S. Phillips.

Rostafinski, J. Beiträge zur Kenntniss der Lange. Heft I. Leipzig, 1875. B. Westerman & Co.

Russ, Dr. Karl. Die fremdländischen Stubenvögel. 4e Lief. Hannover, 1876. I. V. Williamson Fund.

Rütimeyer, L. Ueber Pliocen und Eisperiode auf beiden seiten der Alpen. Basel, 1876. Wilson Fund.

Saldanha da Gama, Dr. José de. Apostillas para o estudo dos Systemas cristallinos de Naumann escriptas. The Brazilian Centennial Com.

Notes in regard to some Textile Plants of Brazil.

Catalogue of the Products of the Brazilian Forests. Brazilian Centennial Commission.

Sandberger, Dr. Die prähistorische Zeit im Maingebiete. The Author.

Sands, B. F. Reports of the Total Solar Eclipse of Dec. 22, 1870. U. S. Naval Observatory. Washington, 1871. Dr. F. A. Hassler.

Say's American Conchology. J. S. Phillips.

Schimper, W. Ph. Synopsis Muscorum Europæorum. Vols. 1 and 2. Editio Secunda. I. V. Williamson Fund.

Schlegel, H. Museum d'Histoire Naturelle des Pays-Bas. 12me Livr. 1876. Wilson Fund.

Schmidt, A. Atlas der Diatomaceen-Kunde. 1es–10es Heft. Aschersleben, 1875. I. V. Williamson Fund.

Schmidt, H. D. Synopsis of the Principal facts elicited from a series of Microscopical Researches upon the Nervous Tissues. The Author.

Schulz, D. Guillermo. Descripcion Geologica de la Provincia de Oviedo. The Geol. Survey of Spain.

Schützenberger, P. On Fermentation. New York, 1876. I. V. Williamson Fund.

Scudder, S. H. Extract from the Bulletin of the Geol. and Geogr. Survey of Territories. Vol. II., No. 3.

A Cosmopolitan Butterfly.

Entomological Notes, V.

Synoptical Tables for determining N. A. Insects. Orthoptera. The Author.

Fossil Coleoptera of the Rocky Mountain Territories.

Fossil Orthoptera of the Rocky Mountain Territories. The Author.

New and Interesting Insects from the Carboniferous of Cape Breton. The Author.

Secchi, P. Angelo. Sulla Relazione dei Fenomeni Meteorologici colle variazioné del Magnetismo terrestre. 2a Edizione.

Misura della Base trigonometrica esequita sulla Via Appia del P. A. Secchi. Rome, 1858.

Sulla Grande Nebulosa di Orione. Firenze, 1868.

Studii intorno ai diametri Solari. Roma, 1874.

Bulletino meteorologico dell' Osservatorio del Collegio Romo. Vols. VI.–XVI. Roma, 1867–1875. Rev. Angelo Secchi.

Semper, Dr. C. Reisen im Archipel der Philippinen. 2er Theil. Wissenschaftliche Resultate. 2er Band, X. Heft. 3er Band, III. Heft. Wilson Fund.

[illegible]ographical Maps of Brazil. The Brazilian Commission.

Catalogue of the Birds in the British Museum. Vol. II. Striges. London, 1875. I. V. Williamson Fund.

Sibthorp, Johannes. Floræ Græcæ Prodromus; sive plantarum omnium enumeratio quas in Provinciis aus Insulis Græciæ. 2 vols. 8vo. Londini, 1813. John E. Cook.

Siebke, H. Enumeratio Insectorum Norvegicorum. Fasc II. University of Norway.

Simpson, J. H. Engineer Depart. U. S. A. Report of Exploration across the Great Basin of the Territory of Utah in 1859. Washington, 1876. The Department.

Smith, Geo. The Chaldean Account of Genesis. New York, 1876. Ward B. Haseltine.

Souverbie, Dr. et R. P. Montrouzier. Description d'espèces nouvelles de l'Archipel-Calédonien. The Authors.

Sowerby's Conchological Illustrations. 1841. J. S. Phillips.

Sowerby's Thesaurus Conchyliorum. Parts I.–XI. J. S. Phillips.

Special Catalogue of the Mexican Section of the International Exhibition, 1876. The Mexican Commission.

Spencer, Herbert. The Study of Sociology.
Principles of Biology, 2 vols.
Principles of Psychology, 2 vols.
Essays, 1 vol.
First Principles of Philosophy.
Descriptive Sociology, Nos. 1 and 2. I. V. Williamson Fund.

Squier's Aboriginal Monuments. 1849. J. S. Phillips.

Sterne, C. Werden und Vergehen. I. V. Williamson Fund.

Stewart, Balfour. The Conservation of Energy. New York, 1874. J. A. Ryder.

St. John, O. Notes on the Geology of Northeastern New Mexico. Department of Interior.
Another copy. Dr. Hayden.

Stoppani, l'Abbé Antoine. Paléontologie Lombarde. Livr. 51–53. Wilson Fund.

Strecker, Herman. Lepidoptera, Rhopaloceres, and Heteroceres, No. 13. Reading. The Author.

Stuart, James M. The History of Free Trade in Tuscany. London, 1876. The Cobden Club.

Sturm's Deutschlands Fauna. VI. Abth. Die Würmer. 1–8 Heft. Nurnberg, 1806. J. S. Phillips.

Supplement to Wood's Index Testaceologicus, 1828. J. S. Phillips.

Sutro, A. Five Pamphlets on the Sutro Tunnel. Adolph Sutro through W. H. Dougherty.
Lectures on Mines and Mining.
Report of the Commissioners and Evidence in regard to the Sutro Tunnel. Washington, 1872.
The Bank of California against the Sutro Tunnel. 1874. A. Sutro, through Dr. Franklin Stewart.

Tatton, J. W. Plans of the Province of Nelson (New Zealand), showing the Mineral Deposits. Dr. James Hector.

Taunay, A. D'Escragnola. La Retraite de Laguna. Rio Janeiro, 1871. The Author.

Tavares, J. P. Memoria sobre a Sericicultura no Imperio do Brazil. The Brazilian Centennial Commission.

The Empire of Brazil at the Universal Exhibition of 1876 in Philadelphia. Same in German. Brazilian Centennial Commission.

The Medical and Surgical History of the War of the Rebellion. Part II. Vol. II. Surgical History. Washington. 1876. Surgeon General U. S. A.

The Penny Cyclopedia. Parts 67 and 80. J. S. Phillips.
The Photographs of the Cohoes Mastodon. Rev. Jas. Hall.
Thompson, C. G. Skandinaviens Hymenoptera. 4e Delen. I. V. Williamson Fund.
Thorpe's British Marine Conchology. 1844. J. S. Phillips.
Todaro, Augustino. Hortus Botanicus Panormitanus. Folio Tract, 1875. I. V. Williamson Fund.
Topinard, Dr. Paul. Bibliothèque des Sciences Contemporaines. L'Anthropologie. Paris, 1876. I. V. Williamson Fund.
Törnebohm, A. E. Geognostisk Beskrifning ofver Persbergets Grufvefält. Geol. Surv. of Sweden.
Trabalhos da commissao Scientifica de Exploraçaş. Introducçao, Seccao Botanica, 1o Folheto. The Brazilian Centennial Commission.
Trafford, F. W. C. Amphiorama ou la Vue du Monde. Lausanne, 1875. The Author.
Tremaux, P. Principe Universel du Mouvement et des Actions de la Matière. The Author.
Troschel, F. H. Das Gebiss der Schnecken. 2en Bandes, 4e Lief. Berlin, 1875. Wilson Fund.
Turton's Conchological Dictionary. 1819. J. S. Phillips.
U. S. International Centennial Exhibition of 1876. Catalogue of the Articles and Objects Exhibited by the U. S. Navy Department. 1876. The Navy Department.
Van Beneden, P. J. Animal Parasites and Messmates. New York, 1876. Wilson Fund.
Van Lennep, H. C. Roeter. Catalogue Alphabétique des Cones. B. Westerman & Co.
Vilanova y Piera. D. Juan. Essayo de Descripcion geognostica de la Provincia de Fernel. The Geol. Survey of Spain.
Vodges, A. W. A Monograph of American Trilobites. Part I. The Author.
Vollenhoven, S. C. Snellen van. Pinacographia. Part 2, Afl. 2. Part 3, Afl. 3. 'S. Gravenhage, 1876. I. V. Williamson Fund.
Wallace, A. R. The Geographical Distribution of Animals. 2 vols London, 1876. I. V. Williamson Fund.
Wareg-Massalski, Urbain. Recherches sur les Acides Chloro-Bromo-Propioniques Glyceriques. Lovain, 1875. Cath. Univ. of Louvain.
Wedekund, Dr. Ludwig. Studien im Binären Werthgebiet. Carlsruhe 1876. The Author.
Wheeler, Geo. M. Annual Report upon the Geographical Explorations an Surveys West of the 100th Mer. in California, Nevada, Nebraska Utah, Arizona, Colorado, New Mexico, Wyoming, and Montana 1875. Washington. The Author.
Same. Report. Vol. III. Geology. Vol. V. Zoology. Engineer Department, U. S. A.
Whitney, Henry M. The Hawaiian Guide Book. John A. Ryder.
Wiedersheim, Robt. Salamandrina perspicillata und Geotriton fuscus. V. Williamson Fund.
Wilder, Burt G. Note on the development and homologies of the Anterior Brain-Mass in Sharks and Skates. The Author.
Williamson, Wm. C. On Recent Foraminifera of Great Britain. I. V. Williamson Fund.

thology. Vols. 1–3, 8vo. Phildelphia, 1828.

Wisconsin, the State of.
Normal School System of Wisconsin.
College of Wisconsin.
History of Education in Wisconsin. Wisconsin Centennial Com.
Wood's Index Testaceologicus, 1828. J. S. Phillips.
Worthen, A. H. Geol. Surv. of Illinois. Vol. VI. Geology and Palæontology. 1875. The Director.
Wulsten, Carl. The Silver Region of the Sierra Mojada. Denver, 1876. The Author.
Wundt, Wilhelm. Ueber den Einfluss der Philosophie auf die Erfahrungswissenschaften. Leipzig, 1876. Wilson Fund.
Zacharias, Dr. Otto. Zur Entwicklungstheorie. Jena, 1876. I. V. Williamson Fund.
Zittel, Karl A. Handbuch der Palæontologie. 1 Band, 1 Lief. I. V. Williamson Fund.
Fauna der Aeltern Cephalopoden Fuehren den Tithonbildungen. Text and Atlas. I. V. Williamson Fund.

JOURNALS AND PERIODICALS.

NORWAY AND SWEDEN.

Christiania. Nyt Magazin for Naturvidenskaberne. 21de Binds, 1 and 2 Hefte, 1875.
Fordhandlinger i Videnskabs-Selskabet i Christiania, Aar 1874. University of Norway.
Stockholm. Kongliga Svenska Vetenskaps-Akademiens Handlingar. Ny Följd, Bandet 9–12. 1870–73.
Ofversigt of the same. 28–32. 1871–75.
Bihang of the same. Vols. 1 and 2; Vol. 3, Häfte I.
Lefnardsteckningar of the same. Band 1, Heft 3. The Society.
Trondhjem. Det K. Norske Videnskabers Selskabs Skrifter i det 19de. Aashundrede. 1875.
Aarsberetning, for 1874. The Society.

DENMARK.

Copenhagen. Mémoires de l'Académie Royale de Copenhagen. 5me Série. Classe des Sciences. Vol XI., No. 2; Vol. XII., No 2. The Society.
Oversigt over der K. D. Videnskabernes Selskabs Forhandlinger. 1874, No. 3; 1875, No. 1. The Society.
Mémoires of the same. 5me Série. Vol. X., Nos. 1–9; Vol. XI., No. 1; Vol. XII., No. 1. The Society.
Videnskabelige Meddelelser fra Naturhistorisk Forening, 1874 and 1875. The Society.

RUSSIA.

Dorpat. Sitzungsberichte der Dorpater Naturforscher Gesellschaft. 4er Band, 1er Heft, 1875. The Society.
Archiv für die Naturkunde Liv-Ehst- und Kurlands. Herausgegeben von der Dorpater Naturforscher Gesellschaft. 2e Série. 5er Band. 1876. The Society.
Helsingfors. Bidrag till Kannedom af Finlands Natur och Folk utgifna af Finska Vetenskaps Societeten. Tjugondefjerde Häftet. 1875.
Öfversigt of the same. XVII. 1874–75.

Observations Météorologiques publiées par la Société des Sciences de Finland. Année 1875. The Society.

Acta Societatis Scientiarum Fennicæ. Tome X. 1875. The Society.

Moscow. Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1875, Nos. 1–4. The Society.

St. Petersburg. Tableau Général méthodique et alphabétique des Matières contenues dans les publications de l'Acad. Imp. des Sciences. Ire Partie, 1872. The Society.

Bulletin of the same. Tome XX., No. 3, to tome XXI., No. 5, inc.

Memoirs of the same. Tomes XXII., Nos. 4 to 10; tome XXIII., No. 1. The Society.

Verhandlungen der Kaiserlichen Gesellschaft für die gesammte Mineralogie. Jahrg. 1862 and 1863. 2e Series, 1er–9er Band, 1867–1874. The Society.

Repertorium für Meteorologie. Herausg. von der K. Akad. der Wissen. Band V., Heft. 1. 1876. The Society.

Annalen des Physikalischen Central Observatoriums. Jahrgang 18[illegible]74. The Observatory.

HOLLAND.

Amsterdam. Verslagen en Mededeelingen der K. Akademie van Wet[illegible]schappen. Afd. Natuurk. Deel XV.; Tweede Reeks, Deel VIII. [illegible] IX. Afd. Letterk. Tweede Reeks. Deel IV.

Jaarboek, 1873 and '74.

Catalogus van de Boekerij, 1en Deels, 1e Stuk.

Processen-Verbal. Afd. Naturerk, 1873–75.

Verhandelingen. 14 and 15 Deel. Afd. Letterk. 8e Deel. The Society.

Haarlem. Naturkundige Verhandlingen der Hollandsche Maatschappij der Wetenschappen. 3de Verz. Deel II., Nos. 3 and 4, 1874. The Society.

Archives Néerlandaises. Vol. X., Livr. 4 and 5; Vol. XI., 1re Livr. 1875–76. The Society.

Archives du Musée Teyler. Vols. 1 and 2, Vol. 4, Fasc. 1er, 1867–76. The Society.

Leiden. Annalen der Sternwarte in Leiden, 4er Band, 1875. The Observatory.

Utrecht. Nederlandsch Meteorologisch Jaarboek voor 1871. Uitgegeven door het K. Nederlandsch Meteorologisch Instituut. 23er Jahrg. 2e Deel. 1875. The Institute.

GERMANY.

Augsburg. Dreiundzwanzigster Bericht des naturhistorischen Vereins in Augsburg, 1875. The Society.

Bamberg. Ueber das Bestehen und Wirken des naturforschenden Vereins. 2er–4er Bericht 1854–59.

Fünfter, Neunter und Zehnter Bericht der naturforschenden Gesellschaft, 1860–61, 1870–74. The Society.

Berlin. Monatsbericht der K. P. Akademie der Wissenschaften zu Berlin. Juli, 1875–Juli, 1876, inc. The Society.

matische Abhandlungen der K. Akademie der Wissenschaften a. Aus dem Jahre 1874 and 1875. The Society.

Sitzungs-Berichte der Gesellschaft naturforschender Freunde zu Berlin. Jahrg 1875. The Society.

Monatschrift des Vereines zur Beförderung des Gartenbaues. 18 Jahrg. Jan.–Dec. 1875. Katalog der Bibliothek. 1875. The Society.

Botanischer Jahresbericht. Herausgegeben von Dr. Leopold Just. 2er Jahrg. 1e–3e Abth., 1874. I. V. Williamson Fund.

Zeitschrift der Deutschen geologischen Gesellschaft. XXVII., 2–4 Heft XXVIII., 1 Heft, 1876. The Society.

Zeitschrift für die gesammten Naturwissenchaften. Neue Folge, Band XI. and XII. The Editor.

Archiv für Naturgeschichte. 39er Jahrg. 5er Heft, 41er Jahrg. 3er, and 4er Heft. 42er Jahrg, 1er Heft, 1876. The editor.

Deutsche entomologische Zeitschrift, 1875, 2es Heft; 1876, 1es Heft. The Publishing Society.

Bonn. Verhandlungen des naturhistorischen Vereins der Preussichen Rheinlande und Westphalens. 31er and 32er Jahrg. 1874. The Society.

Archiv für mikroskopische Anatomie, 12er Band, 1es–4es Heft. 13er Band, 1es Heft, 1876. I. V. Williamson Fund.

Braunschweig. Archiv für Anthropologie. 8er Band, 3es–9er Band, 3es Vierteljahrshaft. I. V. Williamson Fund.

Bremen. Abhandlungen herausgegeben von naturwissenschaftlichen Vereine zu Bremen. 4 Bd., 4 Heft; 5 Bd., 1 Heft. Beilage No. 5. The Society.

XIX. Jahres-Bericht des Schwedischen heilgymnastichen Institutes, 1876. The Director.

Brünn. Verhandlungen des naturforschenden Vereins in Brünn. XIII. Band, 1874. Katal. der Bibl. The Society.

Buda Pest. A Magyar Tudomanyos Akadémia Értesitöje. Hetodik Evfolyam 8 Szam; Nyolezadik Evfolyam, 17 Szam, 1873–75.

M. Tudom. Akad. Almanach, 1864–76.

Mathematikai és Termeszettudomanyi Közlemenyek vonatkozolag a hazai viszonyokra. VII.–X. Kötet, 1869–72.

Ertekezesek a Mathematikai Tudomanyok Köréböl. II. Kötet, 3 Szam; VI. Kötet, 6 Szam.

Jegyzeke a M. Tud. Akad. altat kiadott Könyveknek jelentekenyen leszallitott Arakon, 1875.

Név-és Targymutató a M. Tud. Akad. Ertesetö jének, I. VIII., 1867–74.

A. M. T. Akad. Evkönyvei XIV. Kötet, IV. and V. Darab.

Cassel. Malakozoologische Blätter. Bd. 22, Bg. 13 et seq., Bd. 23, Bg. 1 and 2, pp. 33–144. I. V. Williamson Fund.

Chemnitz. Fünfter Bericht der naturwissenschaftlichen Gesellschaft, 1875. The Society.

Danzig. Schriften der naturforschenden Gesellschaft. Neue Folge. 3en Bandes, 4es Heft. The Society.

Darmstadt. Notizblatt des Vereins für Erdkunde. I.–III. Jahrg, inc. The Society.

Dresden. Sitzungs-Berichte der naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrg. 1875. The Society.

Nova Acta Academiæ Cæsareæ Leopoldino-Carolinæ Germanicæ Naturæ Curiosorum. Tome 37, 1875. The Society.

Leopoldina. 10es Heft, 1874. The Society.

Mittheilungen aus dem K. zoologischen Museum. 1 Heft. Royal Museum at Dresden.

Mittheilungen über die Sammlung der K. mathem-physikalischen Salons. Royal Museum at Dresden.

XII. Jahresbericht des Vereins für Erdkunde, 1875. The Society.

Emden. 61er Jahresbericht der naturforschenden Gesellschaft, 1875.

Kleine Schriften of the same. XVII. Hannover. The Society.

Erlangen. Sitzungsberichte der physikalisch-medicinischer Societät. 7 Heft, 1875. The Society.

Frankfurt a M. Jahrsbericht uber die Verwaltung des Medicinalwesens Stadt Frankfurt a M. Herausgegeben von dem ærztlichen Verein. XVIII. Jahrg. 1874. The Society.

Der Zoologische Garten. XVI. Jahrg. No. 7, 1875. No. 6, 1876. XVII. Jahrg. Nos. 1–6. The Society.

Bericht uber die Senckenbergische naturforschende Gesellschaft, 1873–75. The Society.

Abhandlungen, herausgegeben von der Senckenbergischen naturforschenden Gesellschaft. 9er Band, 3es and 4es Heft, 1874–5. 10er Band, 1–4 Heft, 1876. The Society.

Freiburg. Berichte über die Verhandlungen der naturforschenden Gesellschaft. Bd. VI. Heft 4, 1876. The Society.

Göttingen. Nachrichten von der K. Gesell. der Wissenschaften und der Georg-Augusts-Universitäts aus dem Jahre 1875. The Society.

Hamburg. Verhandlungen des Vereins für naturwissenschaftliche Unterhaltung. 1875, II. Band. The Society.

Journal des Museum Godeffroy. Hefts IX., XI., and XII. I. V. Williamson Fund.

Heidelberg. Verhandlungen des naturhistorisch-medicinischen Vereins. Neue Folge. 1er Band, 3es Heft, 1876. The Society.

Jena. Jenaische Zeitschrift für Naturwissenschaft. Vols. 8, 9, and 10. The Society.

Königsberg. Schriften der physikalisch-ökonomischen Gesellschaft zu Königsberg. 14er Jahrg. 1 and 2 Abth. 15er Jahrg. 1 and 2 Abth., 1873–74. The Society.

Leipzig. Abhandlungen der math.-phys. Classe der K. Sächsichen Gesellschaft der Wissenschaften. X. Band, No. 7. XI. Band No. 5, 1874–75.

Bericht über die Verhandlungen of the same. Math.-physische Classe 1873, III. 1875, I. The Society.

Zeitschrift für Anatomie und Entwickelungsgeschichte. 1es Band 3es–6es Heft. 2es Band, 1 and 2 Heft, 1876. I. V. Williamson Fund.

Archiv für Anatomie, Physiologie und wissenchaftliche Medicin. Jahrg. 1875. Heft III.–VI., 1876, I.–III. I. V. Williamson Fund.

Morphologische Jahrbuch. Von Carl Gegenbaur. 1er Band 3 and 4es Heft, 1875. 2er Bandes and 2es Heft, 1876. I. V. Williamson Fund.

Preisschriften gekönt und herausgegeben von der Fürstlich Jablonowskischen Gesellschaft. XVIII. 1875. The Society.

Zeitschrift fur wissenschaftliche Zoologie. 25er Band, 2 and 3, and Supplementheft. 26er Band 2es–4es Heft; 27er Band, 1es–3es Heft. I. V. Williamson Fund.

Journal für Ornithologie. 23 Jahrg. Heft. I.–II. I. V. Williamson Fund.

Jahrbücher der wissenschaftliche Botanik. 10er Band, 3es Heft, 1876. I. V. Williamson Fund.

Luneberg. Jahreshefte des naturwissenschtlichen Vereins für das Fürstenthum Luneburg. VI. 1872–73. The Society.

Luxembourg. Publications de l'Institut Royal Grand Ducal de Luxembourg. Tome XV. The Society.

Mannheim. 36er–39er Jahresbericht der Mannheimer Vereins für Naturkunde, 1870–76. The Society.

Marburg. Schriften der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg. Band 10. 12e Abth.

Supplement. Heft I. zu Band X. Sitzungsbericht. Jahrg. 1874–75. The Society.

Metz. Bulletin de la Société d'Histoire Naturelle du Départment de la Moselle. 5e–10e, 13e. Cahier, 1848–1874. The Society.

Memoires de l'Académie de Metz. 55e Année, 1873–74. The Society.

München. Sitzungsberichte der mathematisch-physikal. Classe der K. B. Akad. der Wissenchaften zu München, 1874, Heft III.; 1875, Heft I. and III.

Abhandlungen der historischen Classe of the Same. 12er Bandes, 3e Abth.; 13er Bandes, 2e Abth. The Society.

Annalen der K. Sternwarte bei München. XX Band. The Observatory.

Almanach der K. B. Academie der Wissenschaften für das Jahr, 1876. The Society.

Neubrandenburg. Archiv des Vereins der Freunde der Naturgeschichte in Meklenburg. 29 Jahrg., 1875. The Society.

Passau. Zehnter Bericht des naturhistorischen Vereins in Passau für die Jahre 1871 bis 1874–1875. The Society.

Prague. Astronomische, magnetische, und meteorologische Beobachtungen an der K. K. Sternwarte zu Prag im Jahre 1875. The Observatory.

Regensburg, Flora. Herausgegeben von der K. B. botan. Gesellschaft, 1875. The Society.

Stettin. Entomologische Zeitung. Herausgegeben von dem entomologischen Vereine zu Stettin. 36er Jahrg., 1875. The Society.

Stuttgart. Wurttembergisches naturwissenschaftliche Jahreshefte. 22er Jahrg. The Editors.

Neues Jahrbuch für Mineralogie, Geologie, und Palæontologie. Jahrg 1875, 7es–9es Heft; 1876, 1es–3es Heft. The Editor.

Wien. Sitzungberichte der K. Akademie der Wissenschaften. Mathemat. naturwissen. Classe. 70 Band, 1e Abth. III., IV., und V. Heft; 2e Abth. III., IV., und V. Heft; 3e Abth. III., IV., und V. Heft; 71 Band, 1e Abth. I. und V. Heft; 2e Abth. I.–V. Heft; 3e Abth. I. und II. Heft.

Denkschriften of the same. 34er Band, 1875. The Society.

Verhandlungen der K. K. geologischen Reichsanstalt. Nos. 1–18. 1875.

Jahrbuch of the same, 1875. 25 Band, Nos. 3 and 4; 26 Band, Nos. 1 and 2.

Abhandlungen of the same. VI. Band, 2 Heft; VIII. Band, 3 Heft. 1875. The Society.

Festschrift zur Feier des fünfundzwanzigjährigen Bestehens der K. K. zoologisch-botanischen Gesellschaft in Wien, 1876. The Society.

Verhandlungen of the same. 25er Band. The Society.

Schriften des Vereines zur Verbreitung naturwissenschaftlicher Kenntniss in Wein. 14er Band, 1873–74; 16er Band, 1875–76. The Society.

Mittheilungen der anthropologischen Gesellschaft in Wein. VI. Band, Nos. 1–4. The Society.

Würzburg. Arbeiten aus dem zoologisch-zootomischen Institut zu Würzburg. 2er Band, 2–4 Heft, 1875; 3er Band, 1es Heft. I. V. Wil-[illegible] Fund.

[illegible]ren der physikal-medicin Gesellschaft in Würzburg. Neue [illegible]nd, 1–4 Heft; 10 Band, 1–2 Heft, 1876. The Society.

SWITZERLAND.

Verhandlungen der Schweizerischen naturforschenden Gesellschaft. 57 und 58 Jahrsversammlung. 1873-75. The Society.

Basel. Mémoires de la Société Paléontologique Suisse. Vol. II. (1875.) I. V. Williamson Fund.

Verhandlungen der naturforschenden Gesellschaft in Basel. 6er Theil, 2es Heft, 1875. The Society.

Bern. Mittheilungen der naturforschenden Gesellschaft in Bern aus dem Jahren. 1874-75. The Society.

Genève. Bibliothèque Universelles et Revue Suisse. Archives des Sciences Physiques et Naturelles. Nos. 85, 88, 94, 135, 136, 157-168. 1865-71. The Editor.

Mémoires de la Société de Physique et de d'Histoire Naturelle. Tome XXIV., 1e Partie, 1874-75. The Society.

Lausanne. Bulletin de la Société Vaudoise des Sciences Naturelles. Nos. 44, 45, 46, 48, 75 and 76. 1859-1876. The Society.

Neuchatel. Bulletin de la Société des Sciences Naturelles. Tome X., 2d Cahier, 1875. The Society.

St. Gallen. Bericht über die Thätigkeit der St. Gallischen naturwissenschaftlichen Gesellschaft während des Vereinsjahres, 1874-75.

BELGIUM.

Bruxelles. Bulletins de l'Académie Royal des Sciences, des Lettres et des Beaux Arts de Belgique. 2me Série. Tomes 38, 39, and 40, 1874-75.

Mémoires couronnés et autres Mémoires. Collection in 8vo. Tomes 24, 25, and 26. Collection in 4to. Tome 39, 1876. 1re Partie.

Mémoires. Tome 41, Pts. 1 and 2, 1875-76.

Annuaire, 1875 and 1876. The Society.

Annales de la Société Malacologique de Belgique. Tomes 1-4 and 8, and Tome 9, Fasc. 1; Tomes 14me, 17me, and 18me.

Compte Rendu of the same. Serie II., Nos. 16-30. The Society.

Procès-Verbaux des Séances of the same. Tomes 3, 4, and 5. The Society.

Liége. Mémoires de la Société Royale des Sciences de Liége. Tome 14me, 1859. The Society.

Lourain. Société litteraire de l'Universite Catholique de Louvain Choix de Mémoires X., 1869.

Annuaire of the same. 1840, 1844-46, 1850, 1851, 1875, and 1876.

Twenty-eight Theses. The University.

Mons. Mémoires et Publications de la Société des Sciences, des Arts et des Lettres du Hainaut, 1857-60 and 1870. The Society.

FRANCE.

Amiens. Société Linnéenne du Nord de la France. Nos. 1-42. 1872-75.

Mémoires of the same. Années 1866-69, 1872-73. The Society.

Angers. Mémoires de la Société Académique de Maine-et-Loire. Tomes 29-32. 1874-75. The Society.

Auxerre. Bulletin de la Société des Sciences Historiques et Naturelles de l'Yonne. Année 1875. Tables Analytiques, 1875-76. The Society.

Besançon. Académie des Sciences, Belles Lettres et Arts. Séances publiques de 1874-75. The Society.

[illegible] de la Société des Sciences Physiques et Naturelles. [illegible]ex, etc. Tome 1, 2e Série, 2e Cahier, 1876.

Extrait des Procès-Verbeaux des Séances, 1874–5, pp. 13–28. The Society.

Caen. Mémoires de l'Academie Nationale des Sciences, Arts et Belles-Lettres. 1864, 1865, 1869, 1872–75. The Society.

Cherbourg. Mémoires de la Société Nationale des Sciences Naturelles. Tome 19, 1875. The Society.

Lyons. Annales de la Société Linnéenne. Tomes 21 and 22. 1874 and 1875. The Society.

Annales de la Société d'Agriculture, Histoire Naturelle et Arts Utiles. 4me Série, Tome 6me and 7me, 1873–74. The Society.

Mémoires de l'Academie Impériale des Sciences, Belles-Lettres et Arts. Classe des Lettres. Tomes 8 and 16. Paris, 1859–74. The Society.

Nancy. Bulletin de la Société des Sciences de Nancy. Série II., Tome I., 6e Année, 1873, Fasc. III.; Tome II., Fasc. IV. Paris, 1876. The Society.

Orleans. Mémoires de la Société d'Agriculture, Sciences, Belles-Lettres et Arts d'Orleans. Vols. 1–9; Vol. 10, I.; Vol. 11, IV.; Vol. 12, III, and IV.; Vol. 13, III.; Vol. 15, I.–IV.; Vol. 16, I.–IV.; Vol. 17, No. 4; Vol. 18, Nos. 1 and 2, 1876. The Society.

Paris. Comptes Rendus des Séances et Mémoires de la Société de Biologie. 4me Série, Tomes II.–V.; 5me Série, Tome 1–3, 1867–73. The Society.

Comptes Rendus hebdomadaires des Séances de l'Academie des Sciences. Tomes 57–78. Juillet, 1865, Juin, 1874. Tables Générales, 1851–65. The Society.

Supplement to the same. The Society.

Nouvelles Archives du Muséum. Tome 10me, Nos. 1–4. Paris, 1874. The Society.

Bulletin de la Société Zoologique de France. 1re Partie, 1re Année. The Society.

Bulletin de la Société Botanique de France. Tome 21me, 1874, pp. 1–117; 22me, 1875, Nos. 1, 2, and 3. Revue Bibl., B.–E. Tome 23me, 1. The Society.

Bulletin de la Société Geologique de France. 2me Série, Tome 8me, 1850, to 3me Série, Tome 4me, No. 2, 1876.

Lists of the members of the same. The Society.

Annales des Sciences Naturelles. 6me Série. Zoologie, Tome II., No. 1–6; Tome III., Nos. 1–4; Tome IV., No. 3. Botanique, Tome I., Nos. 4–6; Tome II., Nos. 1–6. I. V. Williamson Fund.

Annales des Sciences Geologiques. Tome 6me, Cahier, 2me; Tome 7me, 1er Cahier. The Editors.

Anuales des Mines. 7me Série, Tome IX., 1re. Minister of Public Works, France.

Archives de Zoologie Experimentale. Tome 4me, Nos. 3 and 4; Tome 5me, No. 1, 1876. I. V. Williamson Fund.

Journal de Zoologie, par M. Paul Gervais. Tome IV., Nos. 5 and 6; Tome V., Nos. 1–4. I. V. Williamson Fund.

Bulletin Mensuel de la Société d'Acclimatation. 3e Série, Tome II., Nos. 5–12; Tome III., Nos. 1–9.

Journal de Conchyliologie. 3e Série, Tome XV., Nos. 3 and 4; Tome XVI., Nos. 1 and 2.

Revue Scientifique. 5me Année, 2e Série, Nos. 20–51; 6me Année, Nos. 1–20. The Editors.

Toulouse. Bulletin de la Société d'Histoire Naturelles. 9me Année, 1874–75. The Society.

Mémoires de l'Académie des Sciences, etc. Tome VII., 7me Série, 1875. The Society.

ITALY.

Bologna. Rendiconto delle Sessioni dell' Academia delle Scienze dell' Istituto di Bologna, 1850-51 to 1872-74. Novi Commentarii. Vols. 1-10, 1834-1849. Memorie. Vols. I.-XII., 1850-1861; Serie III., Tomo II., Fasc. 3-4; Tomo V., Fasc. IV. The Society.

Cagnola. Atti della Fondazione Scientifica Cagnola. Vol. VI, Parte I. 1872. The Society.

Catania. Atti dell' Academia Gioenia di Scienze Naturali di Catania. Serie 3, Tomes VI. and IX. The Society.

Lucca. Atti della Reale Academia Lucchese di Scienze Lettere ed Arti. Tomes I., II., IV., XII., XIV., XVI., and two supplementary volumes, 1845 and 1861. The Society.

Milan. R. Istituto Lombardo di Scienze, Lettere ed Arti. Atti, Vol. 1, Fasc. 11-20, 1858-60.

Memorie, Vols. I.-V., Vol. XII., Fasc. 6; Vol. XIII., Fasc. 1.

Rendiconti. Serie II., Vol. VI., Fasc. 6-20; Vol. VII., Fasc. 1-16; Series III., Vol. IV., Fasc. 7. The Society.

Atti della Società Italiana di Scienze Naturali. Vols. XVI., Fasc. 3 and 4, 1874. The Society.

Naples. Atti del Reale Istituto d'Incoraggiamento alle Scienze Naturali economiche e technologiche. Seconda Serie, Tom. II. and IV. 1865 and '67. Tome VIII., Pt. 1, 1871. The Society.

Dei Lavori Accademici del R. Istituto d'Incoraggiamento alle Scienze Naturali, etc., de nell' Anno 1875. The Society.

Società Reale di Napoli. Atti dell' Accademia delle Scienze Fisiche e Mathematiche. Vol. V., 1873. Rendiconto, Vols. 9, 10, 11, 1870-72. The Society.

Pisa. Atti della Società Toscano di Scienzes Naturali. Vol. 1, Fasc. 1 and 2, 1875. The Society.

Torino. Bolletino Meteorologico ed Astronomico del Regio Osservatorio della Regia Universita. Anno VIII., 1875. The Society.

Atti della R. Accademia delle Scienze. Vol. X., Disp. 1a-8a, 1874-75. The Society.

Trieste. Bollettino della Societa Adriatica di Scienze Naturali. Nos. 1 and 6. Annata II., 1876. The Society.

Venezia. Atti del Reale Instituto Veneto di Scienze, Lettere ed Arti. Serie 5, Tome I., Disp. 1-6; Tome II., Disp. 6-10; Tomo III. The Society.

SPAIN.

Madrid. Anuario del Observatorio de Madrid, Ano XI., XII., XIII., XIV.

Observaciones Meteorologicas efectuadas en el Observatorio de Madrid, 1870-73.

Resumen de las Observaciones Meteorologicas efectuadas en la Peninsula, 1870-73. The Observatory.

GREAT BRITAIN.

Belfast. Proceedings of the Belfast Natural History and Philosophical Society, for the session 1874-75. The Society.

Annual Report and Proceedings of the Belfast Naturalist's Field Club. 1874-76. The Society.

Dublin. Transactions of the Royal Irish Academy. Vol. 24. Antiquities Part 9; Science Vol. 24, Part 14 to Vol. 25, Part 20. 1870–75.
Proceedings of the same. Vol. I., Ser. II., Nos. 1, 3–10, Vol. II., Ser. II., Nos. 1, 2, and 3, 1869–75. The Society.
Journal of the Royal Dublin Society. No. 44, Vol. VII., 1875. The Society.
Journal of the Royal Geological Society of Ireland. Vol. IV., Part 2, 1875. The Society.
Proceedings of the Dublin University Biological Association. Vol. I. 1875. The Society.
Edinburgh. Proceedings of the Royal Society of Edinbugh. Session 1874–75.
Transactions of the same. Vol. 27, Pt. 3. The Society.
Transactions and Proceedings of the Botanical Society. Vol. XII., Part 2, 1875. The Society.
Glasgow. Proceedings of the Philosophical Society of Glasgow, 1875–76. Vol. X., No. 1. The Society.
Leeds. Leeds Philosophical and Literary Society. Annual Reports for 1850–51, 1866–67, and 1874–75. The Society.
Liverpool. Proceedings of the Literary and Philosophical Society of Liverpool, No. 29, 1875. The Society.
Second Supplement to the Catalogue of the Liverpool Free Public Library. Reference Department, 1876. The Library.
London. Proceedings of the Zoological Society, 1832–36, 1840, 1843, and 1844. John S. Phillips.
Same. 1864, Pt. 3; 1871, Pts. 2 and 3; 1875, Pt. 2 to 1876, Part 3.
Transactions of the same. Vol. 9, Pts. 1, 5–9. The Society.
Proceedings of the Royal Geographical Society. Vol. 20, Nos. 1–6. The Society.
Journal of the Chemical Society. Aug. 1875, to Jan. 1876. The Society.
List of Officers and Fellows of the same. The Society.
The Quarterly Journal of the Geological Society. Vol. 27, Part 2, and Vol. 29, Part 4 to Vol. 32, Part 3. The Society.
The Journal of the Linnean Society. Vol. XV., Nos. 81–84, Botany; Vol. XII., Nos. 60–63, Zoology.
Additions to Library, 1874–75.
Proceedings, 1874–75.
Transactions, Second Series, Botany, Vol. I., Parts 2 and 3; Zoology, Vol. I., Parts 2 and 3.
General Index to Transactions. Vols. 26 to 30. The Society.
The Journal of the Royal Asiatic Society of Great Britain and Ireland. Vol. VIII., Part I. and II. The Society.
Palæontographical Society. Vol. 29. Issued for 1875. Wilson Fund.
The Journal of the Society of Arts. Vol. 23, 1875. The Society.
Proceedings of the Royal Institution of Great Britain. Vols. VII., Parts V. and VI. 1875. The Society.
The Journal of the Anthropological Institute of Great Britain and Ireland. Nos. 1–15. London, 1875–76. Dr. Jos. Leidy.
Ornithological Miscellany. Edited by Geo. Dawson Rowley. Part 1, No. 2, and Part 2, No. 2. Parts 3 and 4. I. V. Williamson Fund.
London, Edinburgh, and Dublin Philosophical Magazine. 4th series. Vol. 50, Nos. 333 and 334. 5th series, Vol. 1, Nos. 2–11. I. V. Williamson Fund.
The Journal of Anatomy and Physiology. Vol. X., Parts 2, 3, and 4; Vol. XI., Part I.

The Journal of Botany, British and Foreign. Nos. 155–166. I. V. Williamson Fund.
Curtis's Botanical Magazine. 3d Series. Nos. 373–382. I. V. Williamson Fund.
The Geological Magazine. Nos. 137–148. I. V. Williamson Fund.
The Annals and Magazine of Natural History. Nos. 96–107. I. V. Williamson Fund.
The Gardener's Chronicle. Nos. 98–102–105–150. The Editor.
Nature. Nos. 307, 316–318, 321–346, 348–367. The Editor.
Hardwicke's Science Gossip, 1875. Nos. 131–142. I. V. Williamson Fund.
The Popular Science Review. Nos. 58–61. I. V. Williamson Fund.
The Ibis. 3d Series, Vol. 5, Nos. 20, 21, and 22, July.
Notes and Queries. 5th Series, Parts 22–34. The Editor.
Quarterly Journal of Microscopical Science. New Series, Nos. 61–64, 1876. I. V. Williamson Fund.
The Monthly Microscopical Journal. Nos. 84–95. I. V. Williamson Fund.
Zoological Record. Vol. XI., 1874. Wilson Fund.
The Geological Record for 1874. I. V. Williamson Fund.
Trübner's American and Oriental Literary Record. Nos. 113–118. The Publishers.

Manchester. Twenty-fourth Annual Report of the Manchester Free Libraries, 1875–76. The Trustees.

Newcastle-upon-Tyne. Natural History Transactions of Northumberland and Durham. Vol. 5, Part II., 1875. The Society.

Watford. Natural History Society, 1876, List of Members, etc.
Transactions of same. Vol. I., Part 2, 1875. The Society.

UNITED STATES.

Albany. Transactions of the Albany Institute. Vols. VII. and VIII. 1876.
Proceedings of the same. Vol. I. and Vol. II., Part 1. The Society.
University Convocation, 1873–1874. Trustees of the University.
57th Report of the N. Y. State Library, 1875.
26th Report of the N. Y. State Museum of Natural History, 187[illegible]. The Trustees of the University.

Baltimore. Procceedings of the Maryland Academy of Sciences. May 1876. Newspaper slip. Edw. Stabler, Jr.
First Annual Report of the Provost of the Peabody Inst. of Baltimore, 1857. The Institute.
Ninth Annual Report of same, 1876.

Buffalo. Bulletin of the Buffalo Society of Natural Sciences. Vol. II. Nos. 2 and 3, 1876. The Society.

Boston. Memoirs of the Boston Society of Natural History.
Proceedings of the same. Vol. 18, Parts I.–III., pp. 129–336. The Society.
The American Naturalist. Vol. X., Nos. 2–11.
Proceedings of the American Pharmaceutical Association, 1875. The Society.

Cambridge. Bulletin of the Museum of Comparative Zoology. Vol. I. Nos. 3, 4, 7, and 8; Vol. III., Nos. 11–16, 1876.
Memoirs of the same. Vol. IV., Nos. 9–10, 1876.
Illustrated Catalogue of the same. No. VIII. The Director.

Ninth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. 1876. The Trustees.

Quarterly Journal of the Nuttall Ornithological Club. Vol. 1, Nos. 1–4. The Society.

Psyche. Vol. 1, No. 22. The Editor.

Chicago. Engineering News. Vol. III., No. 3.

Proceedings of the Annual Meeting of the Chicago Academy of Sciences, 1875. The Society.

Cincinnati. Proceedings of the Cincinnati Society of Natural History. No. 1, Jan. 1876. The Society.

Same. Charles Dury.

Davenport. Proceedings of the Davenport Academy of Natural Sciences. Vol. I., 1867–1876. D. S. Sheldon.

Same. The Society.

Hanover. Botanical Bulletin. Vol. I., Nos. 3–12; Vol. II., No. 1. The Editor.

Hartford. Fancier's Journal. Vol. 3, Nos. 3–24. The Editor.

Lansing. First published Transactions of the Lansing Scientific Association, Nov. 1875. The Society.

Milwaukee. Jahresbericht des naturhistorischen Vereins von Wisconsin für das Jahr 1876. The Society.

New Haven. The American Journal of Science and Arts, Dec. 1875. Vol. X., No. 60; Vol. XI., Nos. 61–71. The Editor.

Transactions of the Connecticut Academy of Arts and Sciences. Vol. III., Part I., 1876. The Society.

New York. Proceedings of the American Geographical and Statistical Society. Vol. I., No. 2, to Vol. II., No. 4.

Journal of the same. Vol. II., Part 2, and Vols. III.–VI., No. 4.

Bulletin of the same from 1856 to 1874. No. 1, 1875–6.

Annual Record of Science and Industry, 1871–1874. I. V. Williamson Fund.

The Popular Science Monthly. Nos. 46–56. The Editor.

The American Chemist. Vol. 6, Nos. 4–12; Vol. VII., Nos. 1 and 2. The Editor.

Bulletin of the Torrey Botanical Club. Vol. VI., Nos. 3–22.

Supplement to Botanical Dictionary, 1876. The Society.

New York Medical Journal. Vol. 22, No. 6; Vol. 23, Nos. 1–6; Vol. 24, Nos. 1–5. The Editor.

Philadelphia Proceedings of the Academy of Natural Sciences. Part III. 1875. Part. I. and II., 1876. Publication Committee.

Journal of the same. Vols. 1–6. 8vo. Bequeathed by John S. Phillips.

Transactions of the American Entomological Society. Vol. 3, No. 2; Vol. 4, Nos. 3 and 4; Vol. 5, pp. 1–176. The Society.

Proceedings of the American Philosophical Society. Vol. 14, No. 95; Vol. 16, No. 97, 1876. The Society.

Memoirs of the Historical Society of Pennsylvania. Vol. XII. The Society.

The American Journal of Medical Sciences. Nos. 141–144. The Editor.

American Journal of Pharmacy. Vol. 47, No. 12 to Vol. 48, No. 11. The Editor.

The Medical News and Library. Vol. 33, No. 396; Vol. 34, Nos. 397 to 407. The Editor.

The Dental Cosmos. Vol. VI., Nos. 10 and 12; Vol. VII., No. 8; Vol. X., No. 3; Vol. XVII., No. 12, to Vol. XVIII., No. 11. The Editor.

The Penn Monthly. Vol. VI., No. 72, to Vol. VII., No. 83. The Editor.

The Gardener's Monthly. Vol. 17, No. 12, to Vol. 18, No. 11.

The Journal of the Franklin Institute. The Editor.

The Polytechnic Review. Vol. 1, No. 1.

Poughkeepsie. Proceedings of the Poughkeepsie Society of Natural Science. Vol. 1, Fasc. 1, 2, and 3. The Society.

Salem. Proceedings of the American Association for the Advancement of Science. 24th Meeting, 1876.

Memoirs, I., 1875. The Association.

Memoirs of the Peabody Academy of Science. Vol. I., No. IV., 1875. The Society.

Historical Collections of the Essex Institute. Vol. VI., Nos. 5 and 6, to end of Vol. IX.; Vol. X., Parts 2 and 3; Vol. XI., Part I. to Vol. XIII., Part II., 1864–76. Memoires of Henry Coit Perkins and Francis Peabody, and an Address by A. C. Godell, Jr. The Society.

Bulletin of the Essex Institute. Vol. 7, Nos. 6–12; Vol. 8, Nos. 1 and 2. The Society.

San Francisco. Proceedings of the California Academy of Sciences. Vol. V., Part 3, 1874. The Society.

St. Louis. The Transactions of the Academy of Sciences of St. Louis. Vol. III., No. 3, 1876. The Society.

The Western. New Series. Vol. 1, No. 12; Vol. II., Nos. 1, 2. The Editor.

Toledo, Ohio. The Scientific Monthly. Vol. 1, Nos. 6, 10, and 12. The Editor.

Troy. Proceedings of the Semi-Centennial Celebration of the Rensselaer Polytechnic Institute. Troy, 1824–74. The Institute.

Washington. Bulletin of the United States Geological and Geographical Survey of the Territories. Vol. II., Nos. 1–4. 2d Series. Nos. 1, 2, 5, 6. Department of Interior.

Same. Vol II., No. 4; No. 2, 2d Series. F. V. Hayden.

Descriptive Catalogue of the Photographs of the United States Geological Survey of the Territories. 2d Edition, 1875. Department of the Interior.

Bulletin of the United States National Museum. Nos. 1, 4, and 5. Department of the Interior.

Field and Forest. Vol. II., No. 5, 1876. The Editor.

Quarterly Report of the Chief of Bureau of Statistics. Nos. 3 and 4, 1875; Nos. 3 and 4, 1876. Treasury Department.

Report of the Commissioner of Education for the year 1874. The Department of the Interior.

Circular of Information of the Bureau of Education. Nos. 7 and 8, 1875. Department of Interior.

Monthly Report of the Department of Agriculture for October, 1876. The Department.

Report of the Chief of Engineers, 1875. Parts 1 and 2. War De-

mission to Investigate Affairs at the Red Cloud
. Department of Interior.

Worcester. Proceedings of the American Antiquarian Society. Nos. 65 and 66. 1876.
Transactions. Vols. 5 and 6. The Society.

CANADA.

Halifax. Proceedings and Transactions of the Nova Scotian Institute of Natural Sciences. Vol. II. Dr. Honeyman.
Same. Vol. II., Part IV.; Vol. III., Part IV., 1869–74. Purchased.
London, Ca. The Canadian Entomologist. Vol. VII., Nos. 11 and 12; Vol. VIII., Nos. 1–10, 1876. The Editor.
Montreal. The Canadian Naturalist. New Series. Vol. VII., Nos. 7 and 8; Vol. VIII., No. 2. The Editor.
The Canadian Antiquarian. Vol. IV., No. 3; Vol. V., Nos. 1 and 2, 1876. The Editors.
Quebec. Le Naturaliste Canadien. Vol. 7, Nos. 11 and 12; Vol. 8, Nos. 10. The Editor.
Toronto. The Canadian Journal of Science, Literature, and History. Vol. XIV., No. 5; Vol. XV., Nos. 1, 2, 3. The Editor.
Annual Report of the Entomological Society of Ontario, 1875. The Society.

MEXICO.

Mexico. La Naturaleza. Tomo III., Nos. 17, 18, 19, 1875–76. The Editor.
Nueva Farmacopea Mexicana de la Sociedad farmaceutica di Mexico, 1874. Prof. A. Herrera.
Five numbers of the Gaceta Médica de Mexico, 1866 and 1867. Prof. Alfonso Herrera.

SOUTH AMERICA.

Rio de Janeiro. Archives do Museo Nacional do Rio de Janeiro. Vol. 1, lo Tremestre, 1876. The Society.
Revista do Istituto Polytechnico Brasileiro. Tomo 1, Nos. 1 and 2; Tomo 2, No. 2; Tomo 3 and 4. The Brazilian Centennial Commission.
Archivos da Palestra Scientifica do Rio de Janeiro. Vol. I., 1858. Brazilian Centennial Commission.

AFRICA.

Alexandria. Société Kediviale de Geographie. Statuts et Discours par G. Schweinfurth, 1875. The Society.

ASIA.

Calcutta. Proceedings of the Asiatic Society of Bengal. Nos. 6 and 10, 1875.
Journal of the same. Part I., Nos. 2–4, 1875. Part II., Nos. 1–3, and extra number, 1875. Isaac Lea.
Memoirs of the Geological Survey of India. 8vo. Vol. XI., Pt. 2.
Records of the same. Vol. VIII., Parts 1–4, 1875, and Vol. IX., Part 1, 1876.

Memoirs of the same. 4to. Palæontologia Indica. Ser. IX., 4, 1875. Jurassic Fauna of Kutch. Vol. I., 2 and 3. The Survey.

Yokohama. Transactions of the Asiatic Society of Japan. From 13th Jan. 1875, to 30th June, 1875. The Society.

AUSTRALIA.

Brisbane. The Queenslander. Vol. X. New Series, No. 12, 1875. A. Mackay.

Tasmania. Monthly Notices of Papers and Proceedings of the Royal Society of Tasmania for 1874. The Society.

NEW ZEALAND.

Wellington. Transactions and Proceedings of the New Zealand Institute, 1875. Vol. VIII. The Society.

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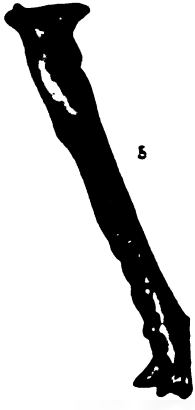
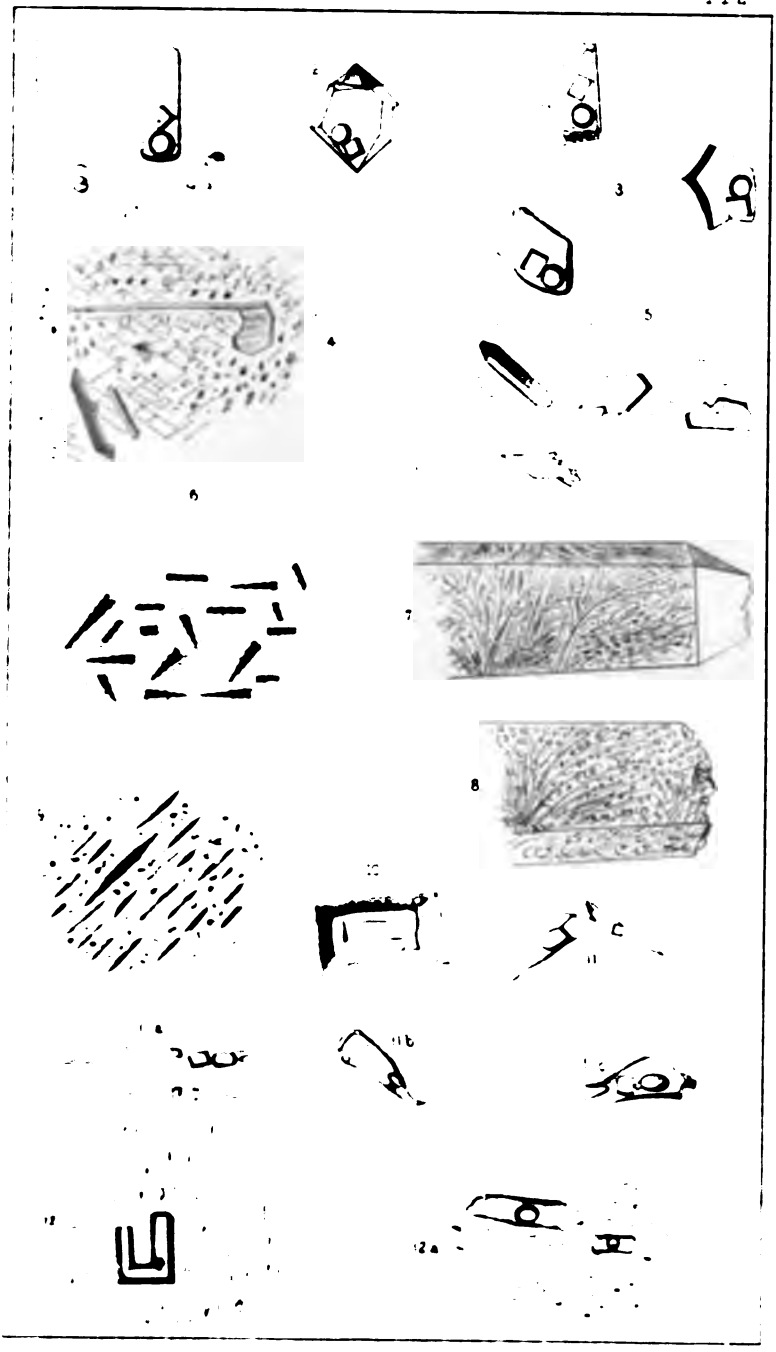


Sherwood & Co. Bowen Court

Bassaricyon Gabbii



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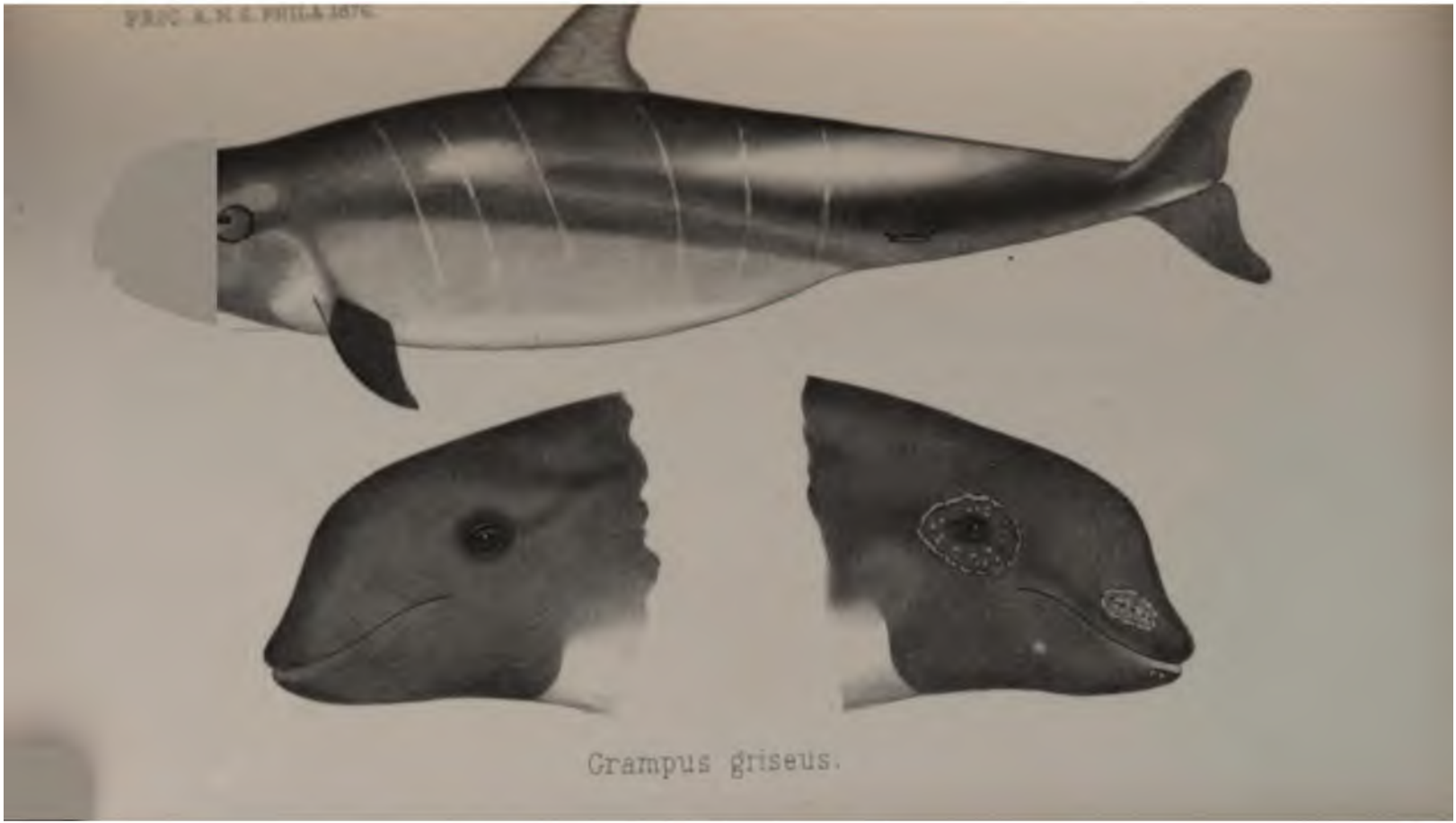

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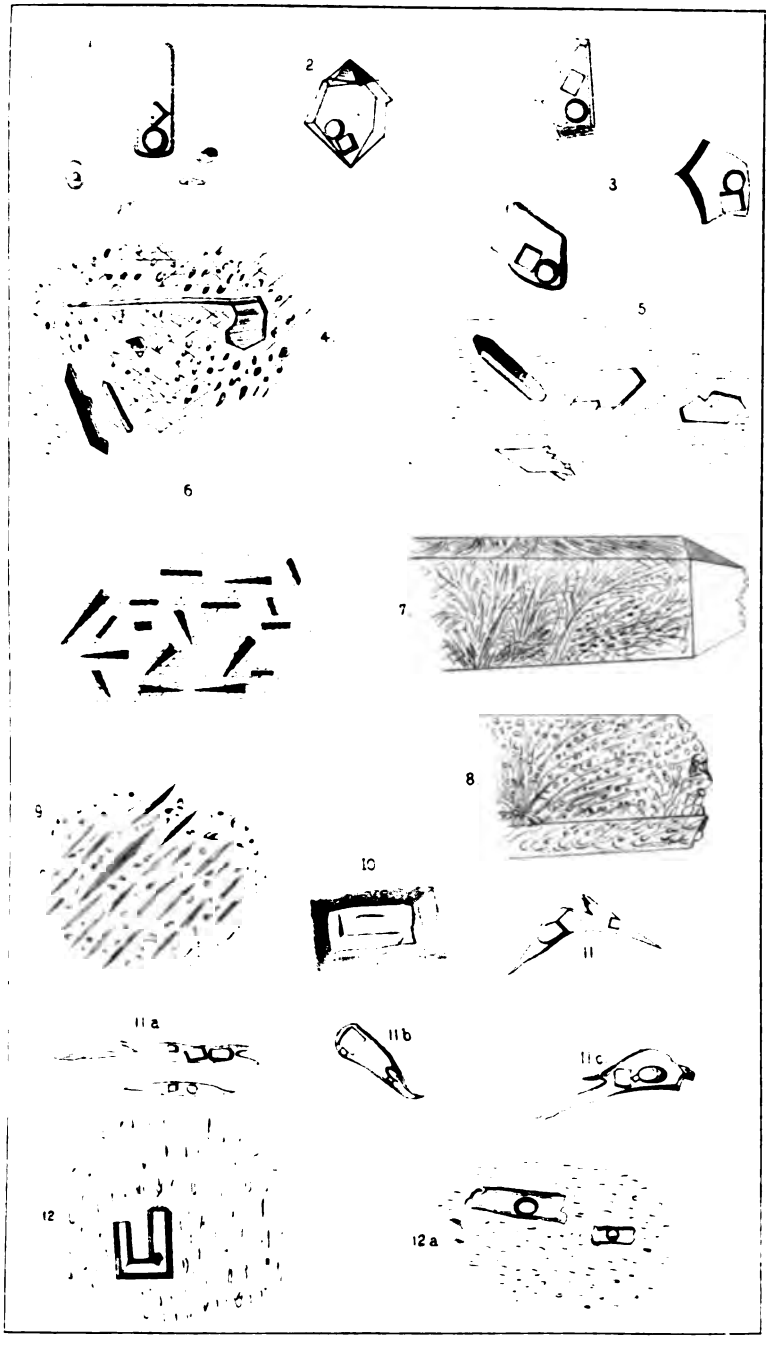

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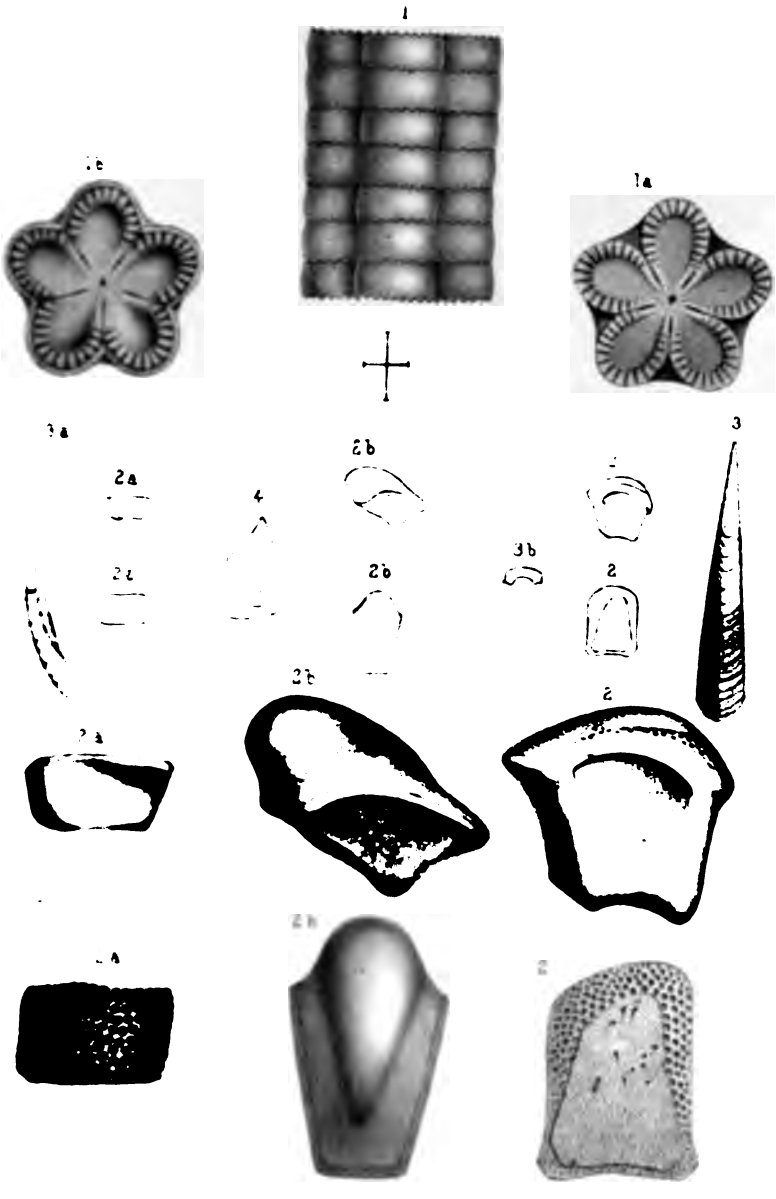

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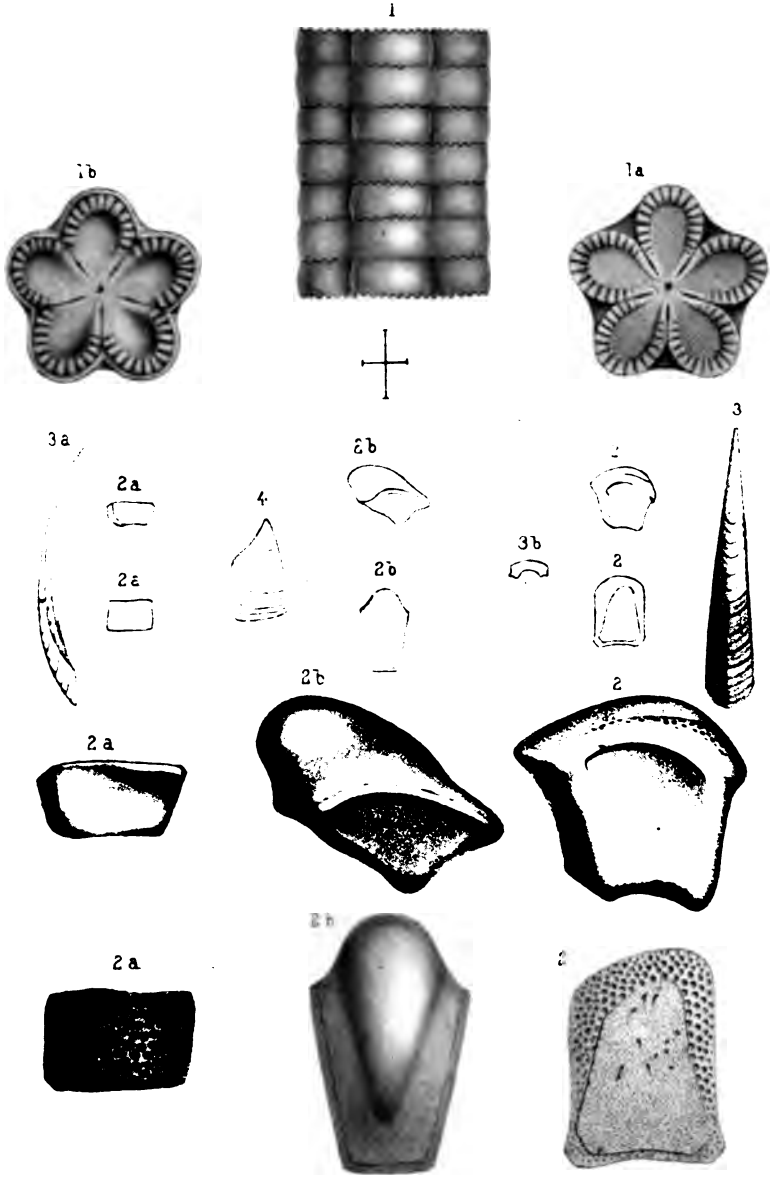
Cretaceous Fossils.

Lagenorhynchus perspicillatus. Cope.



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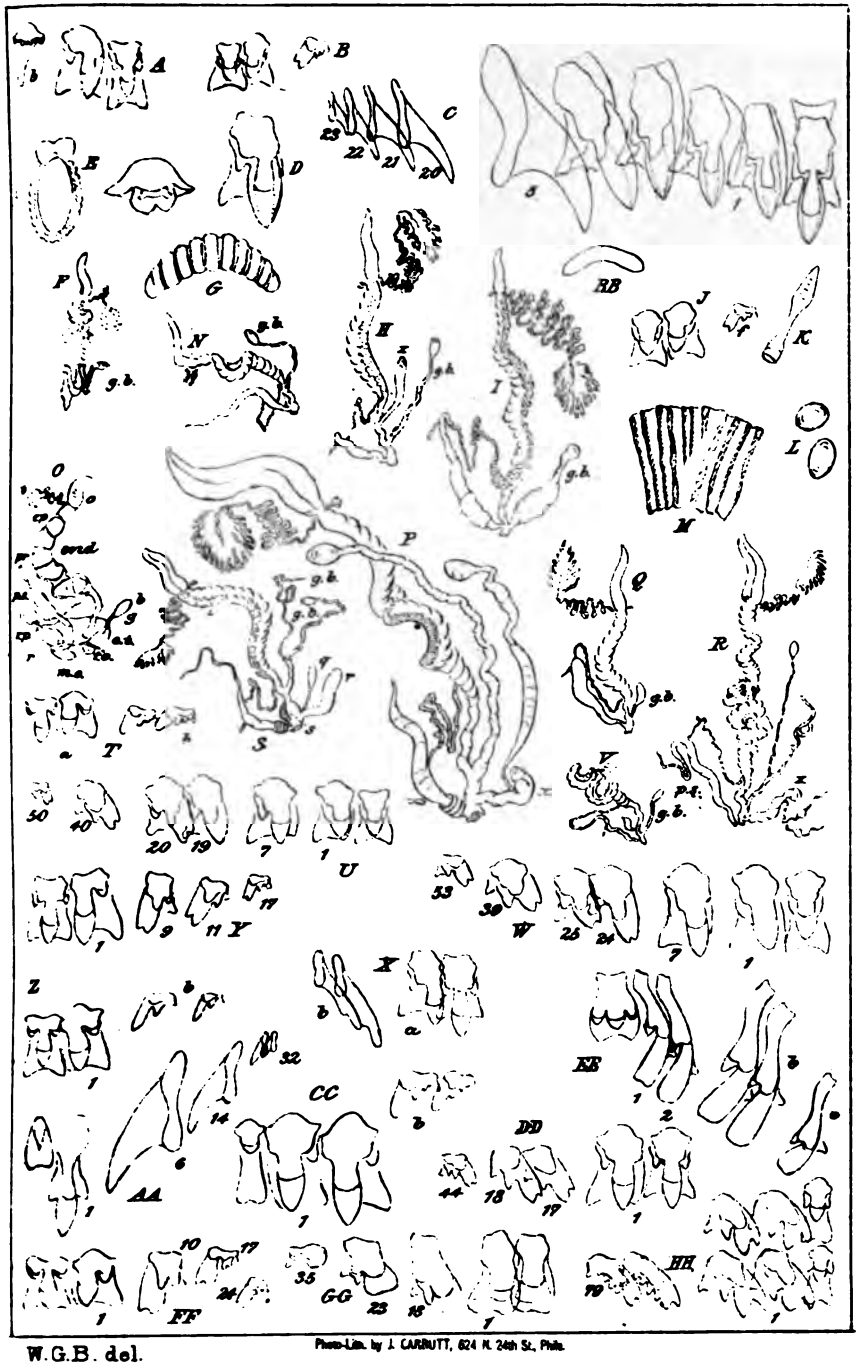
Gabb on New American Cretaceous Fossils.



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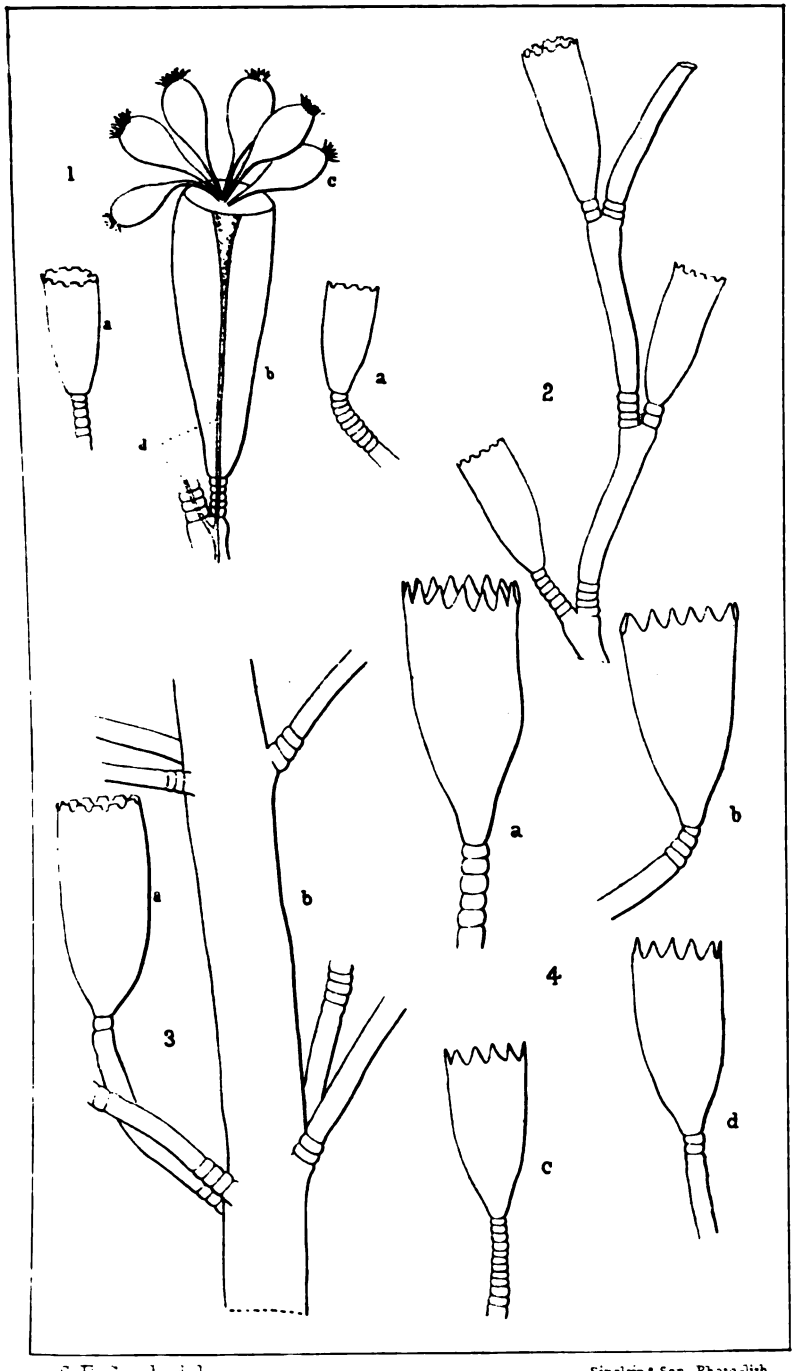

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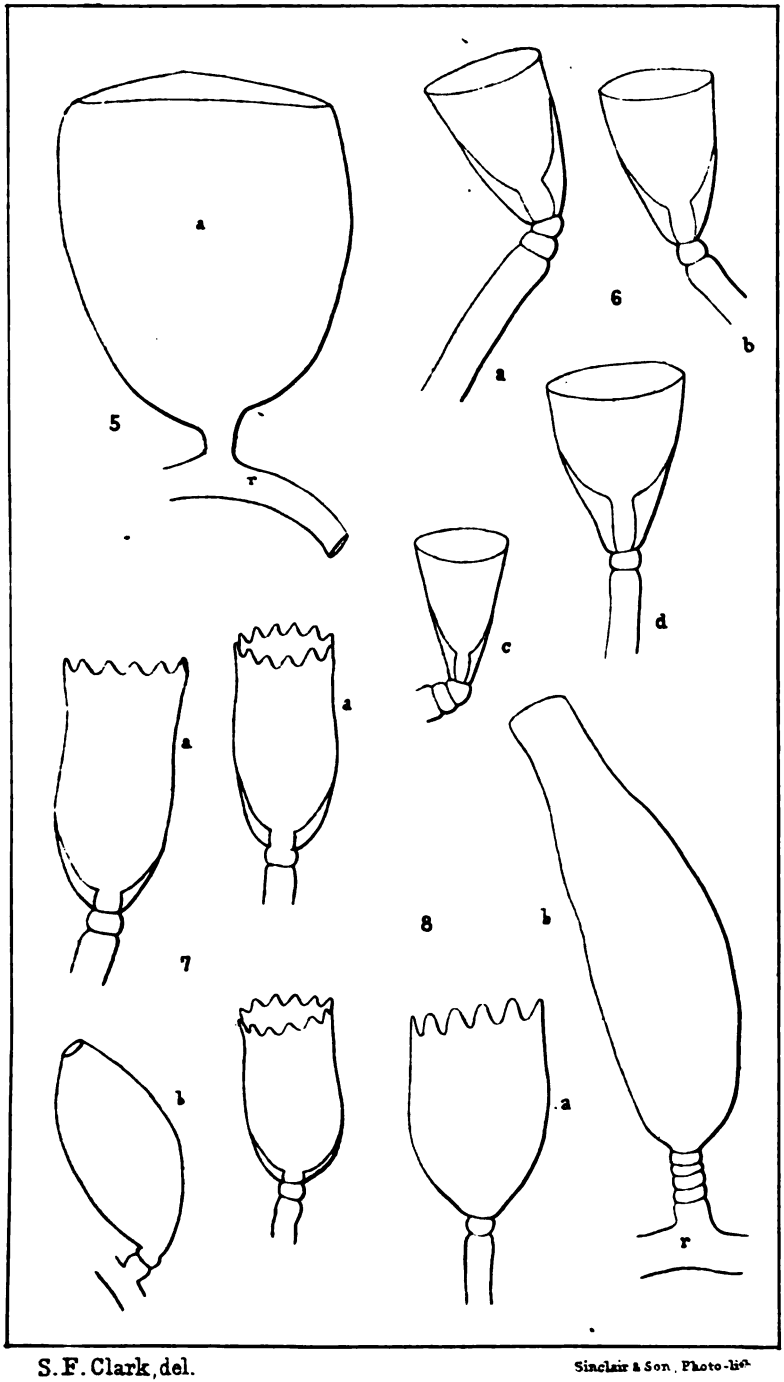

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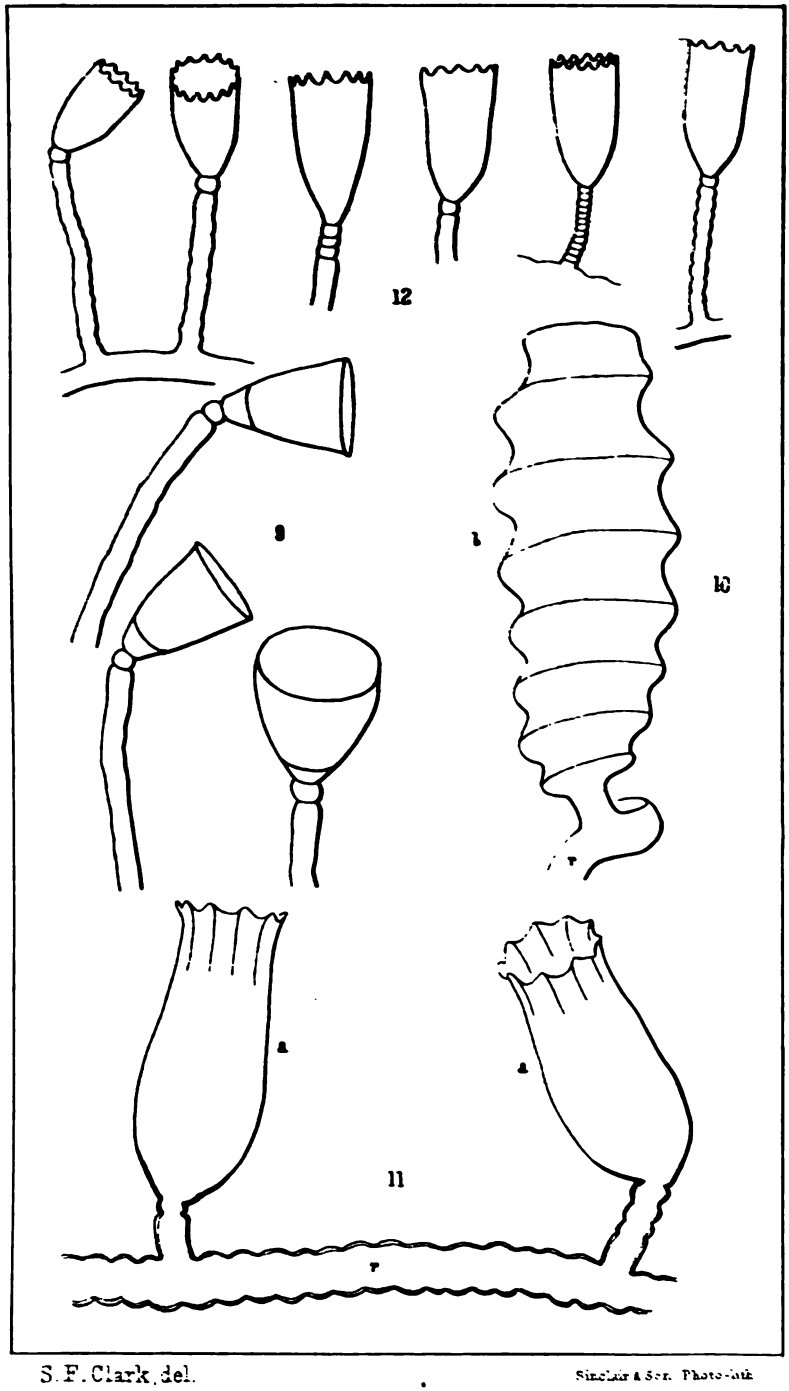

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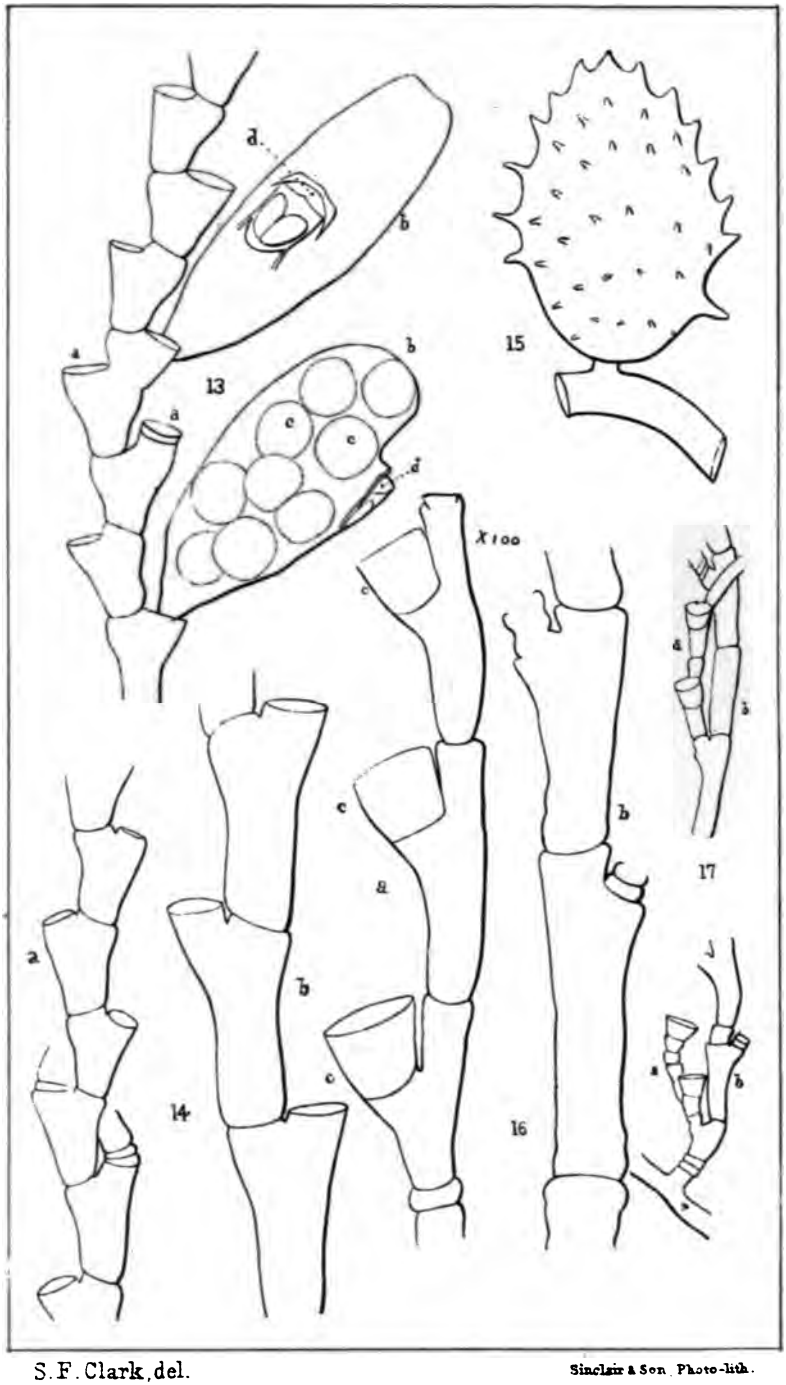

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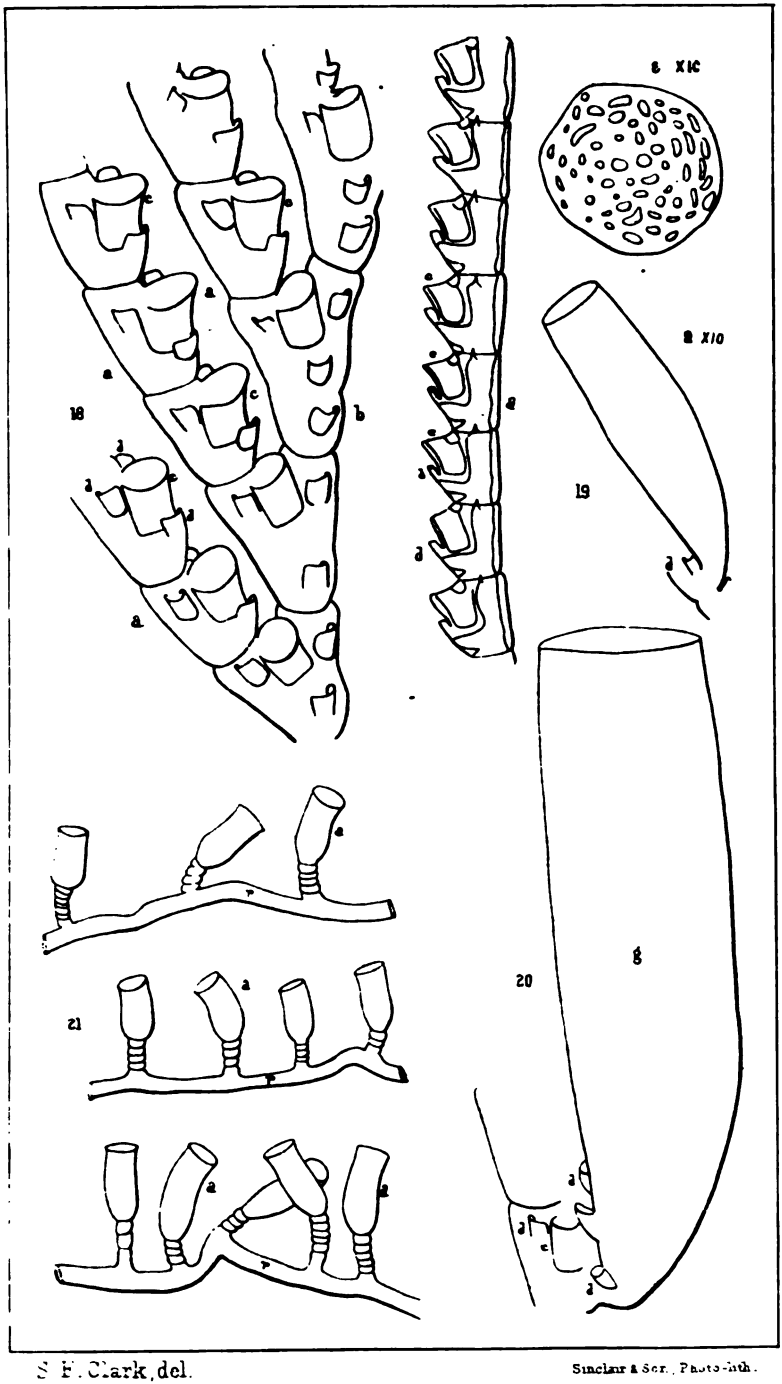

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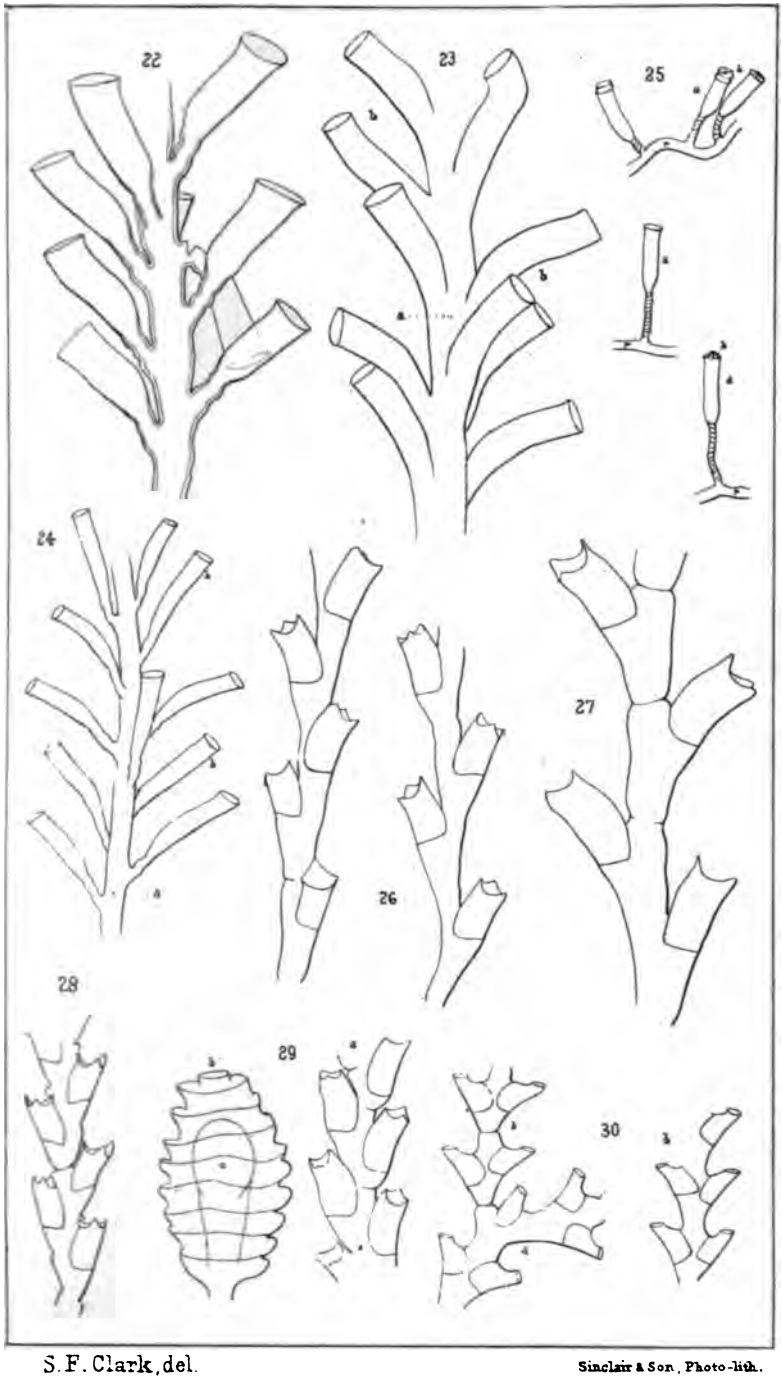

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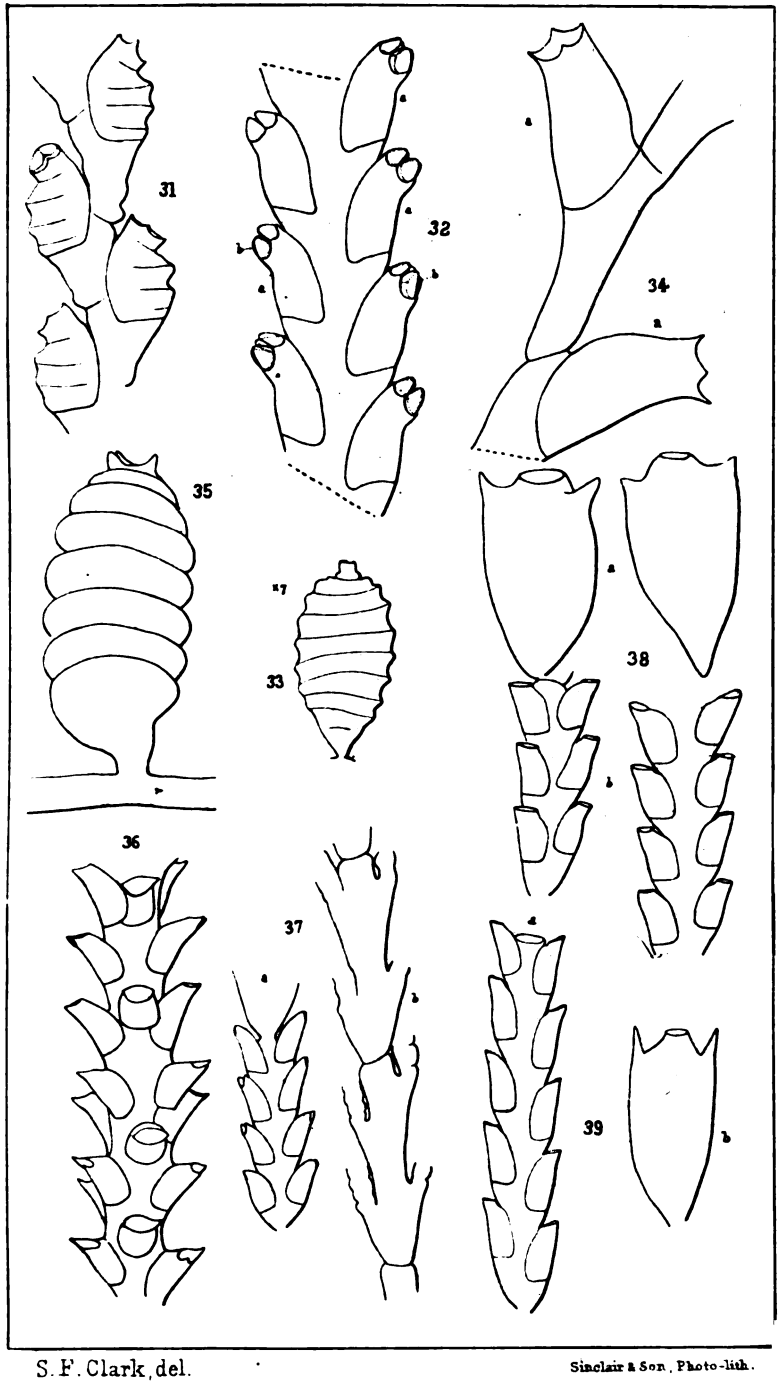

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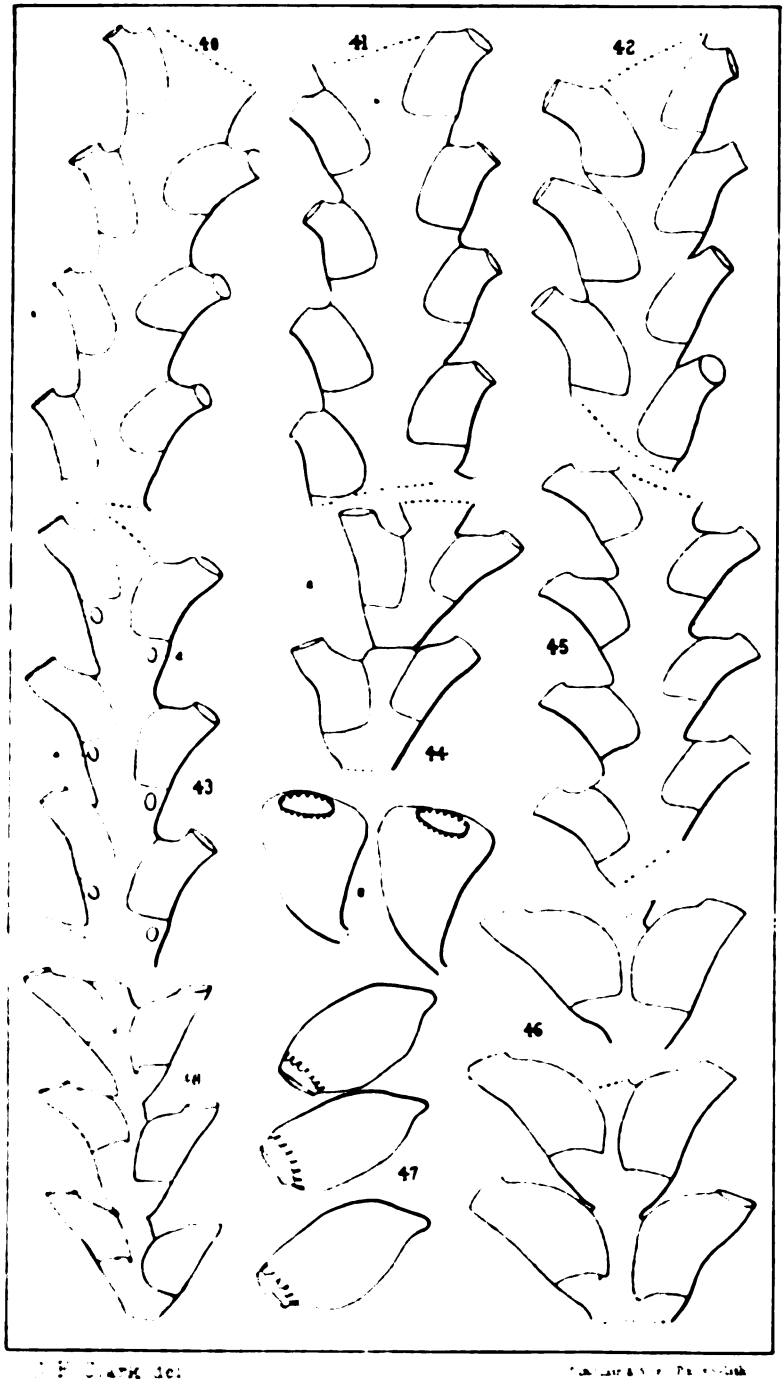

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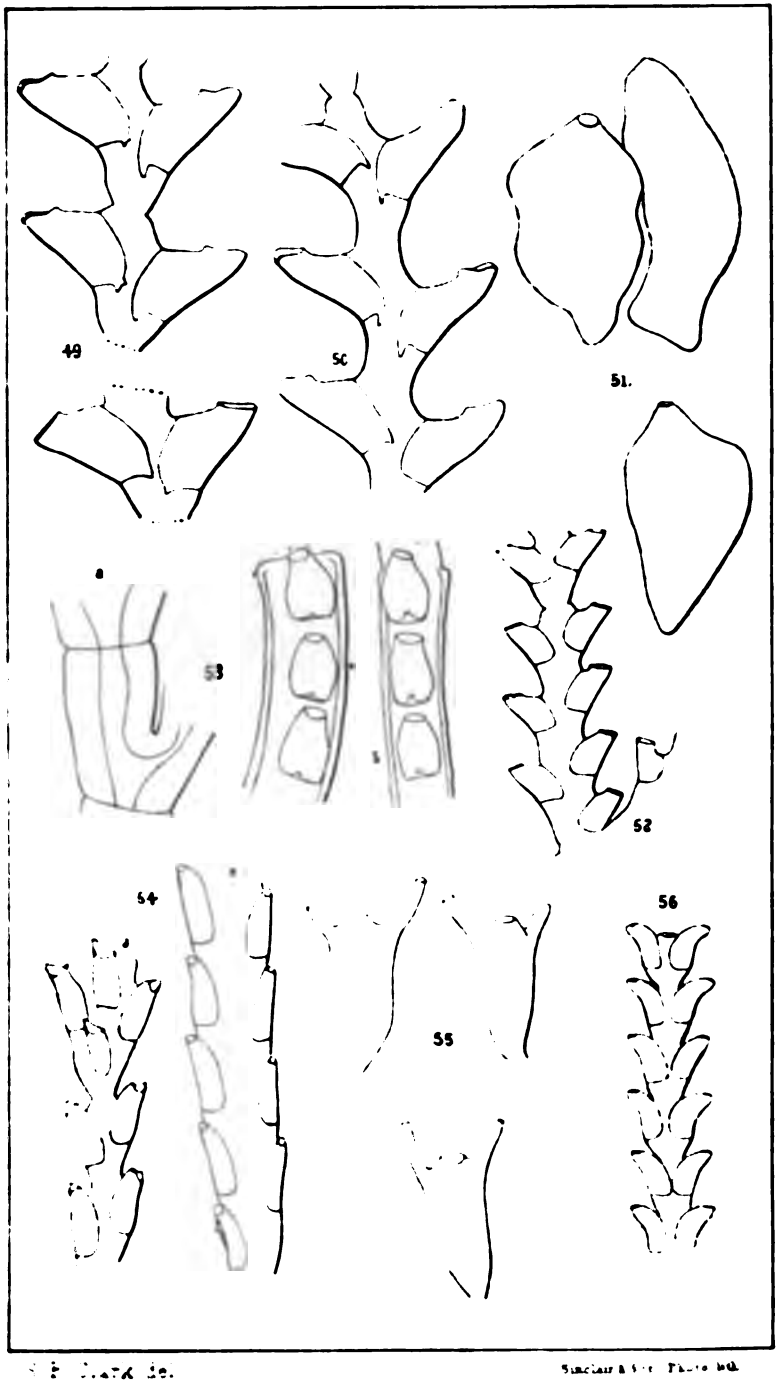

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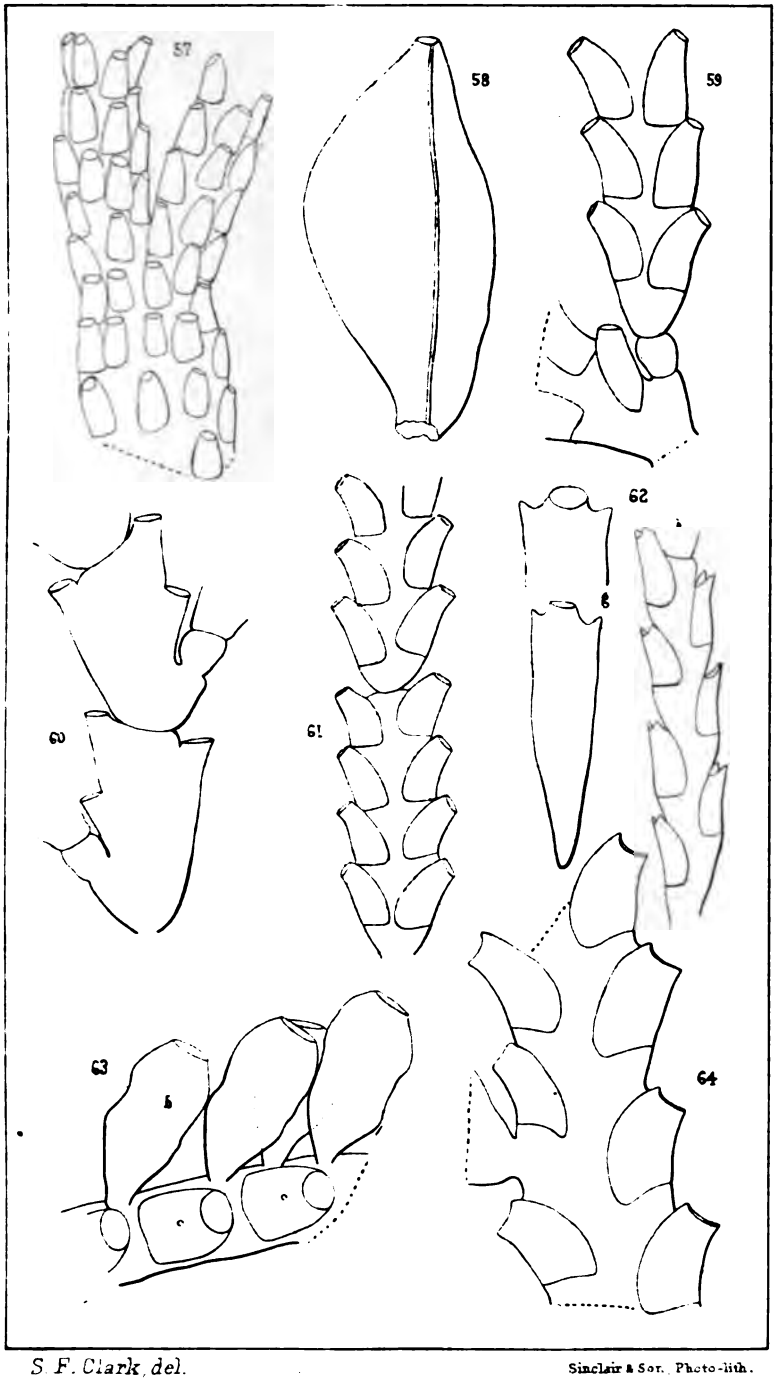

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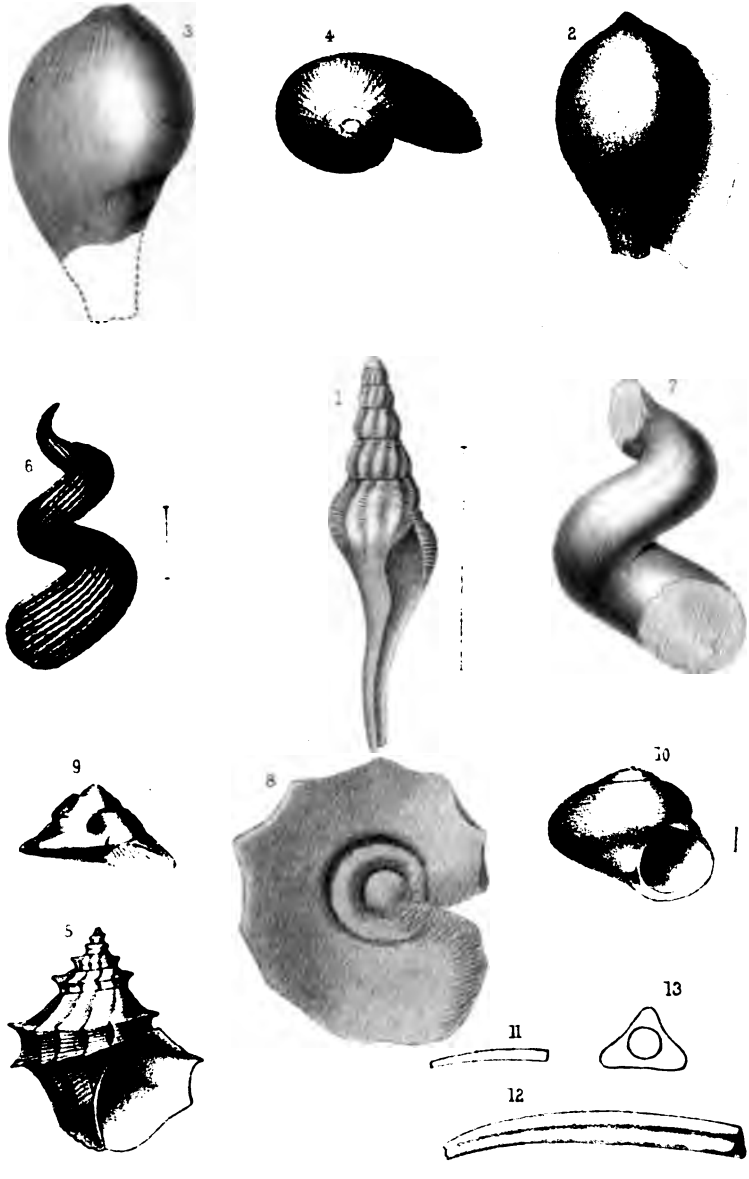

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Gabb on American Cretaceous Fossils.

PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1877.

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PHILADELPHIA:
ACADEMY OF NATURAL SCIENCES,
S. W. Corner Nineteenth and Race Streets.
1877.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
February 15, 1878.

I hereby certify that printed copies of the Proceedings for 1877 have been presented at the meetings of the Academy, as follows:—

Pages	9 to 24	March	13, 1877.
"	25 to 120	April	17, 1877.
"	121 to 136	May	22, 1877.
"	137 to 168	June	26, 1877.
"	169 to 184	July	10, 1877.
"	185 to 216	"	17, 1877.
"	217 to 264	"	24, 1877.
"	265 to 280	October	9, 1877.
"	281 to 296	January	1, 1878.
"	297 to 312	"	15, 1878.
"	313 to 360	February	12, 1878.

EDWARD J. NOLAN,
Recording Secretary.

PHILADELPHIA.
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PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1877.

JANUARY 2, 1877.

Mr. VAUX, Vice-President, in the chair.

Thirty members present.

The deaths of Dr. Jos. Carson and of Mr. F. B. Meek were announced.

The Academy unanimously voted a presentation of thanks to Wm. P. Jenks, Esq., for a portrait of Dr. W. S. W. Ruschenberger, painted in oil by Mr. Wm. K. Hewitt.

JANUARY 9.

Mr. VAUX, Vice-President, in the chair.

Thirty-nine members present.

The resignation of C. H. Howell as a member was accepted.

The following papers were presented for publication:—

"Unionidæ of Ohio and Alabama." By James Lewis, M.D.

"On Certain Generic Names proposed by Zittel, Stoliczka, and Zekeli." By T. A. Conrad.

On Astrophyllite, Arfvedsonite, and Zircon.—Dr. GEO. AUG. KŒNIG spoke of the co-occurrence of *astrophyllite*, *arfvedsonite*

and *zircon* in El Paso Co., Colorado. The minerals are imbedded in quartz, which is massive and of a gray color, occasionally stained with iron ochre, especially in specimens taken from the surface. Astrophyllite was only known to occur in the syenite of Brevig in Norway, being associated there likewise with arfvedsonite and zircon. This association of the three species on points of the globe nearly opposite to each other is very interesting. The matrix, however, is flesh-colored orthoclase at Brevig and gray quartz in Colorado.

1. *Astrophyllite.*—In elongated prismatic forms, with a nearly rectangular cross-section, no terminal faces developed. Measurements made on a crystal of a more complicated form lead to a *monosymmetric* interpretation, while Scheerer determined the astrophyllite from Brevig to be orthorhombic. Cleavage perfect, parallel to the basal plane, producing micaceous habitus. Hardness = 3. Specific gravity at 15° C. = 3.375.

B. B. fuses easily to a black globule. With microcosmic salt gives reactions of silica, iron, manganese, titanium. Decomposed by hydrochloric and sulphuric acids.

Composition—

SiO_2	= 34.68
TiO_2	= 13.58
ZrO_2	= 2.20
Fe_2O_3	= 6.56
Al_2O_3	= 0.70
FeO	= 26.10
MnO	= 3.48
K_2O	= 5.01
Na_2O	= 2.51
MgO	= 0.30
CuO	= 0.42
TaO_2	= 0.80
H_2O	= 3.54
	99.91

This leads to the atomistic symbol—

$$\left.\begin{matrix} IV & IV \\ Si_{13} & Ti_4 \\ II & VI \\ Fe_8 & Fe \end{matrix}\right\} \begin{matrix} II \\ Mn \\ H_8 \end{matrix} \Big\} O_{32}$$
$$K_2 \quad Na_2$$

Note.—Care was taken to eliminate mechanically admixed zircon. The separation of aluminium, titanium, zirconium, was effected by a new colorimetric method (Proceedings American Phil. Soc. Jan. 19, 1876), devised by the speaker.

2. *Arfvedsonite.*—Elongated prisms of the form ∞P. $\infty P\infty$. Angle of prism 124° 30′, of cleavage pieces 124° 5′. Color raven black, lustre submetallic, streak lavender blue, H = 6. Specific gravity at 12° C. = 3.433.

B. B. fuses easily. Reaction with the fluxes of silica, iron, manganese, and titanium with difficulty. Not decomposed by

acids at ordinary pressure, and very slowly in sealed tube. Composition—

SiO_2	= 49.83
TiO_2	= 1.43
ZrO_2	= 0.75
Al_2O_3	= trace
Fe_2O_3	= 15.88
FeO	= 17.95
MnO	= 1.75
Na_2O / LiO	= 8.33
K_2O	= 1.44
MgO	= 0.41
Ignition	= 0.20
	97.97

Atomistic symbol—

$$\left.\begin{matrix} & \text{IV} & \\ & Si_8 & \\ \text{II} & \text{VI} & \end{matrix}\right\}\ \begin{matrix}\text{II}\\ O_{24}\end{matrix}$$
$$Fe_3\ \ Fe\ Na_3\ \Big)$$

3. *Zircon* occurs in tetragonal forms of the combination P. ∞P. 0 P. Basal plane noticed on all crystals. Color, iron-gray; after treating with hydrochloric acid, of a yellowish flesh-color.

Specific gravity at 12° C. = 4.538.

Composition—

SiO_2	= 29.70
ZrO_2	= 60.98
Fe_2O_3	= 9.20
MgO	= 0.30
	100.18

The material for analysis was boiled as powder with hydrochloric acid, until no iron was dissolved. This zircon is, therefore, characterized by an exceptionally high percentage of iron.

The material for examination was furnished by Dr. Foote.

JANUARY 16.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-one members present.

Fertilization of Browallia elata.—The following communication from Dr. ASA GRAY was read at his request by Mr. Thos. Meehan:—

In a paper communicated to the Academy of Natural Sciences, and printed in the "Proceedings" under date of Feb. 8, 1876, Mr. Meehan, upon exhibiting specimens of *Browallia elata* which had

flowered in a green house, and set seed in winter, added the following among other remarks:—

"Not only was it a fact that this plant, with such an attractive blue color, perfected every seed-vessel without insect aid, but the *structure of the flower was such that should any insect endeavor to collect the pollen it would only aid, if that were necessary, in self-fertilization.* The stigma was nearly the length of the corolla-tube; and the anthers, a trifle longer, were arranged closely around it. Two of these were inverted just over the stigma, their backs being densely bearded, and appearing to the naked eye like petaloid processes, effectually closing the mouth of the throat. *No insect could thrust its proboscis into the tube except through this dense bearded mass, and if it had foreign pollen, would be thoroughly cleaned by the beard; but the very act of penetration would thrust these anthers forward on to the pistil, and thus aid in rupturing the pollen-sacs, and of course the self-fertilization of the flower.*"

I have italicized the passages which attracted my attention when I first read this paper in August, and which led me to make some observations for myself. In consequence, when I afterward read a reproduction of this statement in *Nature*, I was constrained to address a note to that paper, in which I expressed the opinion that, as to this matter, Mr. Meehan's observation was incomplete and his inference hasty, or some word to that effect. I have not the printed note before me. In it I stated, simply and substantially, that the throat of the corolla was found by me to be pervious by an orifice or chink directly in front of each of these bearded anthers; that a hog's bristle thrust down these passages, after being slightly moistened, had the inserted portion well supplied with adherent pollen when withdrawn, and that this could be reinserted into another corolla (removed from the plant) without being cleaned off by the beard. I also explained that the structure and collocation of the stigma and upper anthers were such that, in my opinion, the action of an insect would not tend to thrust any pollen of the former upon the actual stigma. I added that the flowers in question were freely visited by Hymenoptera and Lepidoptera of various sorts.

In *Nature* for Dec. 14, I find a rejoinder from Mr. Meehan, which makes (so far as I am concerned) the following points:—

1. Prof. Gray should have noticed that the original observation was made upon a green-house plant in winter, and should have understood the phrase, "*Browallia* is not visited by insects, yet seeds abundantly," to refer only to this condition.

2. "That even though an insect were as careful in finding the chink as Dr. Gray was in his manipulations with the hog's bristle, the obstruction of the mouth in the way it is cannot surely be claimed as an arrangement in favor of cross-fertilization."

"We need not trouble *Nature* any further with this little discus-

sion, and any amends that may be due to Mr. Meehan may be made here; wherefore let me say that I never presumed to question Mr. Meehan's *fact*, viz., that his plant of *Browallia* seeded in winter without insect aid, but only his *inference*, viz., that *Browallia* flowers, on account of their structure, could not or would not in the natural course of things be cross-fertilized by insects. This being understood, it will be apparent:—

1. That I had no occasion to refer to the season in which Mr. Meehan's observation was made and his paper read. That is relevant to the matter I had in hand only as confirming my remark that the observation was incomplete and inference hasty, as the ensuing summer showed.

2. The "obstruction" referred to "surely" was not "claimed as an arrangement in favor of cross-fertilization." The point made was that no obstruction to cross-fertilization exists.

Mr. THOMAS MEEHAN said he was quite willing to grant the correctness of Dr. Gray's point that it was not absolutely impossible that *Browallia* should be once in a while fertilized by an insect in the way suggested. The great object he had had in view in all his papers and remarks on this subject, was anything but to argue against the possibilities of these occasional acts. At the outset of his course on this question, he found Mr. Darwin saying that clover would not fertilize without the aid of the humble bee; and we know the row of consequences built on this supposed fact, that if cats no longer existed, clover would disappear from England. Dr. Gray, himself, in playful earnestness, had suggested as a further disaster, that if there were no old maids to care for the cats, it would be bad for the clover. He had found the whole subject formulated in this wise: all plants with inconspicuous, odorless flowers, are fertilized by the wind; all flowers with color, fragrance, or sweet secretions, are fertilized by insects. Sir John Lubbock expressly declares that "to the unconscious agency of insects, plants owe their color and fragrance." Professor Gray, himself, before the Mount Holyoke Seminary, the year before last, is reported in the Scientific Farmer to have said, "Nature abhors in-and-in breeding; and, like a wise teacher, shuns the practice." It is also on record in the Proceedings, that when he had shown that many composites, *Staphylea* and others, did fertilize themselves, Dr. Gray objected to the whole argument. His (Mr. M.'s) point had been, that Nature did not shun the practice of self-fertilization in flowers; and not by any means that cross-fertilization by insect agency under no circumstances occurred. Professor Gray, in a recent paper, had modified these views. He there stated his position to be now, that plants abhor *perpetual* in-and-in breeding; that Nature says to the plant, "Get cross-fertilized if you can, but anyhow get fertilized;" and admits that cross-fertilization is the great exception to the rule. Of course,

this destroys all the practical sequences, from old maids to fertile clover, for at that time it was thought clover had no choice but to wait the pleasure of the humble bee. There was now nothing left to him to object to, except the interpretation of these exceptional cases of cross-fertilization. He really thought that "exceptional crossing," as a factor in the development of species, involved more difficulties than the "general" theory did; but that was a question for the future. For the present, he was willing to admit that if there was anything in the whole context of his *Browallia* communication indicating that it was impossible under any circumstances that an insect should cross-fertilize it, his friend, Dr. Gray, had the best of that argument.

On the Hudson River and Utica Slates of Pennsylvania.—Prof. PERSIFOR FRAZER, Jr., remarked that it always must be one of the principal objects of a geological survey to restrain people from investing their capital where there is a practical certitude that they will have no return. Probably till the end of our race the investment in pyrites for gold and quartz for diamonds will continue, in spite of the diffusion of knowledge. In Pennsylvania the most fatal delusion is found in the black slate beds of No. 3, (or the Hudson River Slates and Utica Slates, called also Matinal by Rogers). This is because these slates occur frequently at no great geographical distance from the true coal measures, because the slates are unusually black and really somewhat carbonaceous, and because their slickensides frequently impart to certain surfaces a lustre not unlike that of some Schuylkill County anthracite. Rogers (vol. i. p. 239), in speaking of these slates, says: "I regard the thin bed of brownish carbonaceous slate" (the equivalent of the Utica Slate of New York) . . . . "as probably representing the" (lower) "margin of the formation."

Again (Ibid. p. 260), in speaking of the Matinal Slates of the Kittatinny Valley near Dublin Gap, he says: "Some bands of the slate, particularly those lying adjacent to the limestone, are highly carbonaceous and of a dark color, somewhat resembling the slates of the coal measures. This analogy in their appearance, notwithstanding the conclusiveness of all geological evidence to the contrary, induces many persons not familiar with the geology of the country" (sic.) "to suppose that the formation may actually contain *coal*. For the last fifty years" (1858) "excavations have from time to time been made at various places in the valley, in the confident belief that coal will be discovered, and though in every instance unsuccessful, they are still occasionally renewed." The same work (p 472) reaffirms the same view with regard to the place in the series of this black belt.

On p. 480 Mr. Rogers says: "At Copeland's Mill" (Kishacoquillas Valley) "the lower beds of the slate are so black as to have seduced proprietors into an unavailing search for coal. It is the matinal black slate, and of course cannot indicate coal."

Nevertheless these attempts continue to succeed each other in spite of the advice of experts. Indeed the projector of such an enterprise frequently regards as impertinent intrusion the well-meant warning which might save him from pecuniary loss.

A recent instance of the effect of these delusions is to be found in a tunnel driven by Mr. Gosherd, of Franklin County, into the hard slates which form a terrace along the side of the North Mountain close by Franklin Furnace. Mr. Gosherd first became aware of the existence of "*a treasure*" on his property through a dream, in which he seemed to be standing in a certain field of his farm and at a point which he was afterwards able to find without difficulty. On awaking he told his dream to the members of his family, and lost no time in repairing to the spot indicated. As he says, "at the first stroke of the spade black dirt was turned up, and at a short distance below the surface, coal was found equal, in the opinion of a coal operator from Harrisburg, to the best Lykens Valley coal." It occurred to Mr. Gosherd that as the point of this discovery was on the sharply-sloping flank of the mountain, it would be advisable to drive a tunnel across the rocks from the base of the terrace. He has thus executed a very creditably-cut tunnel, some 330 feet long, partly by hired labor, but principally by his own, at a cost of about $1500. The heading of this tunnel was in the black stratum which was wrought by the first preliminary excavation. The rocks which were passed through were hard, not very fissile bands of one or more inches in thickness, except the last stratum, which was a band of pulverulent argillaceous matter inclosing a hard mass of slate.

Various specimens were selected and submitted to approximate analysis:—

A 1. A hard dark slate, much intersected by quartz veins, both large and small, from the heading of Gosherd's tunnel, half a mile N. E. of Franklin Furnace.

A 2. The same brayed in the iron mortar and panned to separate the finer quartz particles and concentrate the carbonaceous matter.

B. Black argillaceous slate or "horse" in the middle of the soft stratum in which Mr. Gosherd's tunnel heads.

D. Soft pulverulent stuff called "coal" by Mr. Gosherd, ten feet from heading of tunnel

The coarse powder was first heated three hours to 120° Cent. and weighed, then successively reheated to the same temperature till no loss of weight occurred. The covered crucibles were gradually raised to full redness and then kept for three minutes at a white heat, to ascertain the amount of volatile organic matter. The carbon was ascertained by difference after the calcination of the residue. The following is the result:—

	Per Cent.			
	A 1.	A 2.	B.	D.
Hygroscopic moisture,	0.05	0.55	2.28	1.56
Volatile organic matter,	5.76	8.89	4.40	3.99
Ash,	91.40 Brick-red.	62.52 Brick-red.	90.87 Light cream-pink.	90.35 Light cream-pink.
Carbon (by loss),	2.79	28.04	2.40	4.06
Sulphur,	3.46	——	——	——
Metallic iron,	7.84	——	——	——

Supposing all the sulphur united to the iron to form pyrites, we would have—

	Per Cent.
Iron pyrites,	6.49
Iron as free oxide and as basic constituent of ash,	4.81

In the above results several things are worthy of remark. First, the amount of carbon which these slates contain is inconsiderable. Even when concentrated by pulverizing and panning, the amount of combustible matter does not reach one-third of the total weight. It may be added that much of this fixed carbon is in the form of graphite.

Another point is the comparatively large amount of volatile organic substances, which, in view of the last statement, is quite unexpected, for in those carbonaceous strata in which the carbon is chiefly graphite, the volatile organic substances are generally reduced nearly to zero.

The amount of hygroscopic moisture is low in all of the specimens, and in the case of A 1 is, of course, without signification, owing to the mode of preparation of the analysis.

Anthracite from "Third-Hill Mountain," West Virginia.—Prof. Persifor Frazer, Jr., stated that some specimens of coal from this locality had been subjected by him to proximate analysis two years ago. The locality was eighteen miles east of Berkeley Springs or Bath, West Virginia. At that time the exposures were few, shallow, and much washed in, and the specimens consequently not fair representatives of the coal. Since then, last summer, he obtained from Mr. Pendleton, of Bath, specimens of a much better coal collected by that gentleman from the same vicinity. There are some reasons for ascribing to this coal a horizon below the carboniferous series, and this lends to its constitution additional interest. The following is an analysis of it:—

	p. c.
Hygroscopic moisture	0.21
Volatile hydrocarbons	7.66
Ash (light gray)	5.35
Free carbon (by difference)	86.78
Sulphur (probably trace)	not determined
Iron (under 1 p. c.)	not determined

The lustre resembles that of some Schuylkill County anthracite.

JANUARY 23.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-eight members present.

JANUARY 30.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-one members present.

The resignation of F. W. J. Wylie as a member was read and accepted.

The following papers were presented for publication:—

"On Certain Excrementitious Deposits from the West." By H. W. Henshaw.

"The Valsei of the United States." By M. C. Cooke.

In conformity with Art. III, Chap. V, of the By-Laws, Jos. Willcox, Wm. S. Vaux, Rev. E. R. Beadle, Jos. Leidy, Chas. F. Parker, W. S. W. Ruschenberger, E. Goldsmith, Persifor Frazer, Jr., Wm. H. Dougherty, Theo. D. Rand, Clarence S. Bement, and Chas. C. Phillips were constituted the Mineralogical Section of the Academy of Natural Sciences of Philadelphia.

On Copper-bearing Rocks of the Mesozoic Formation.—Prof. PERSIFOR FRAZER, Jr., remarked that the existence of copper in the shales and sandstones of the Mesozoic era has long been known, and many of the copper industries derive their material from such sources. The whole of the band of micaceous and specular iron ores which lies along the northwestern border of the New Red Sandstone is saturated with copper salts, and cupriferous strata are frequently found among the rocks of the central portions of the basin.

One of the latter recently discovered lies about five miles east of the town of Gettysburg, at the hamlet of Bonnaughton or "Bunnytown," as it is pronounced.

About 300 yards south of Mr. Liver's house, in a field, is an excavation made in Sept. 1876. While cutting off the corn, numbers of outcrop specimens of malachite were observed strewed over the surface of the ground. The rocks here are very much broken. The most homogeneous of them consist of a red sandstone, which is hard and compact, regarded in large blocks, but the latter are intersected by innumerable cleavage planes.

The general dip is about N.W. 30°. The cupriferous strata are about one foot thick, while the clay and rocks both above and below this are much impregnated with copper. Some of the accompanying rock appears to be calcareous, with small prisms of perfectly transparent quartz.

In the sandstone are pits showing the section of cubes of pyrite more or less hydroxidized.

The strike of these cupriferous measures seems to extend at least a mile on either side.

The portion which might be called a bed vein of copper ore was, as is said, about 1 foot thick. That is to say, that the decayed argillaceous material composing this foot was sufficiently green to render it worthy of being called an ore.

This seam was selected and averaged, and submitted to three determinations of the contained copper.

The following is the record:—

	p. c.
Insoluble silicious residue	79.78
Sesquioxide of iron present (over 5 p. c.) .	not determined
Copper by electrolysis	2.65

While on this subject, it may not be inappropriate to say one word as to the readiest methods of determining copper.

Of the various methods of *indirect* determination, but one was selected (viz., that of Rose) for comparison with the results obtained by precipitation of metallic copper on a tared platinum dish.

The results follow:—

		p. c.	mean.
Cu	by Rose's method[1]	2.55	2.53
	by Pfaf's method[2]	2.40	
	by Luckow's method[3]	2.65	

The difficulties experienced in the practical use of the second of these methods, when a large number of analyses are to be undertaken in a limited time, are very great. The solution of the zinc in a liquor strongly saturated with salts is slow and irregular; towards the close of the operation, small pieces of

[1] Precipitating in acid solution by sulphydric acid, and igniting with excess of sulphur.

[2] Precipitating in acid solution by zinc. There was a slight loss of copper in this analysis.

[3] tating by the battery in acid solution.

undissolved zinc are likely to be commingled with the granular copper, and not to be separable therefrom; if the solution be kept in contact with the deposited copper until the analyst is assured that the zinc is all dissolved, part of the copper is sure to go into solution.

For these reasons, one of the worst processes for rapid copper determination is the production of metallic copper by means of reduction by zinc. A modification, or rather a suite, to this process is that by Steinbeck, which, with another, took the prize offered by the Mansfield Copper Works.

It consists in dissolving the copper precipitated by zinc in nitric acid, and titring with cyanide of potassium.

For practical purposes, and whenever a battery is to be had, the electrolytic method seems more rapid and exact.

To recapitulate:—

	1st.	2d.
Insoluble residue	79.73	78.11
Iron sesquioxide	over 5 p. c.	

Metallic copper (Rose's), 2.55; (Pfaf's), 2.40; (Luckow's), 2.65.

Contamination of Drinking Water.—In connection with the contamination of potable water and the manner in which such contamination may manifest itself, Prof. PERSIFOR FRAZER, Jr., presented the following partial examination of the well-water used at the parsonage of St. James the Less. The priest of this church, Rev. Robert Ritchie, having noticed that the water from the well was at times fetid and nauseating, brought about three gallons for inspection. The water was collected, according to advice, in a demijohn previously well washed out with the same water. It was collected early in the morning of a day in April, 1874. It was fairly clear. Upon examination it yielded:—

	Grammes per litre.	Grains per gallon.
Mechanically suspended matter . . .	0.006	0.42
Precipitate after evaporation to one-third of its original volume	0.062	4.34
Total dissolved matter dried at 120° Cent., 11.344 grammes[1]	0.997	69.93
Volatilized at a red heat	0.024	1.68

The water emitted an offensive odor after standing in a warm place twenty-four hours. It assumed a yellow tint and gave an acid reaction when reduced by evaporation to one-half its volume, shortly after which a bulky yellow precipitate was thrown down. When reduced to 30 or 40 c.c. bunches of acicular white crystals began to be deposited. On ignition, an intensely foul odor was given off. Residue chiefly iron sesquioxide.

[1] The determination of the total dissolved matter here given must be regarded as somewhat in excess of the amount actually present in the water.

The well is situated about one hundred yards from the graveyard of the church, and between it and the river. Between the burial-ground and the river the ground slopes gradually. Since the fall of 1874, the water has been purer, but many cases of diphtheria have occurred at various times in the rectory.

Dr. LEIDY remarked that his attention had been repeatedly directed to an impurity in our drinking-water differing from that usually mentioned. It often conspicuously appeared in the otherwise clear water when first drawn from the hydrant into a white basin or a tumbler, as diffused brownish or yellowish flakes. Though comparatively light, they soon settle to the bottom of the vessel. When first noticed he supposed that they were fragments of decaying woody fibres. On microscopic examination, he thought that he had recognized them to be largely composed of the castings of worms mingled with remains of confervæ and animalcules. The source of these he suspected to be the soft mud at the bottom of our reservoirs. This mud rapidly accumulates in the latter from the sediment of the Schuylkill water, and is a favorable nidus for the development of worms, various animalcules, and the growth of algous plants. He had often observed such mud colored bright red from the multitude of worms partially buried in it with the tail ends protruded and vibrating. The mucus secretions of the worms mingled with mud particles form tubes, and it is these which he thought he had recognized as forming most of the flakes in the drinking-water. The more frequent cleansing of the reservoirs from the accumulating sedimentary mud, Dr. L. thought, would promote the purity and healthfulness of the water.

On Eozoon.—Dr. LEIDY directed attention to the large and characteristic specimen of *Eozoon Canadense*, presented this evening by the Geological Survey of Canada.

For the information of those not familiar with the object, Dr. L. stated that it was regarded by many of the best zoologists as of animal origin, and as such had excited much interest from its being the oldest known fossil. It was found in the Laurentian rocks of Canada, and is considered to be the remains of a coral-like Rhizopod. Dr. L. was himself not fully convinced of its animal nature.

On the Diaphragm.—Dr. LEIDY remarked that the elevation of the dome of the human diaphragm was usually as high as the fifth rib, but that in the subject, used during his present anatomical course at the University, a well-formed muscular male, the diaphragm on the right side was elevated to a level with the anterior extremity of the third rib.

The following were elected members: C. W. Cross, J. T. Montgomery, Jos. M. Stoddart, Dr. H. Ernest Goodman, Dr. Thomas Biddle, Jr., Wm. G. Audenried, Dr. Jos. Thomas, Dr. I. S. Moyer, and Clarence C. De Lannoy.

Dr. J. M. Da Silva Coutinho, of Rio Janeiro, Dr. Wm. A. Mintzer, U. S. N., Prof. L. Nicholsky, of St. Petersburg, Gen. A. Gadolin, of St. Petersburg, Nikolai v. Kokscharow, of St. Petersburg, and Prof. L. de Koninck, of Bruxelles, were elected Correspondents.

The following papers were ordered to be printed:—

ON CERTAIN GENERIC NAMES PROPOSED BY ZITTEL, STOLICZKA, AND ZEKELI.

BY T. A. CONRAD.

I propose the following rectification of generic names published by Zittel in his description of Gosau-Fossils:—

Table	1.	Fig.	1.	Diploconcha, Con.	= Fistulana tubulosa, Zit.
"	"	"	3.	Leptosolen, Con.	= Siliqua Petersi, Reus.
"	"	"	5.	Liopistha, Meek,	= Panopæa frequens, Zit.
"	2.	"	3.	Liopistha,	= Pholadomya granulosa, Z.
"	"	"	10.	Baroda, Stolic.	= Tapes eximia, Zit.
"	3.	"	2.	Baroda,	= Tapes Martiniana, Math.
"	"	"	3.	Baroda,	= Tapes fragilis.
"	"	"	7.	Cyprimeria, Con.	= Circe discus, Math.
"	4.	"	1.	Cyprimeria,	= Circe concentrica, Zit.
"	"	"	8.	Venilia, Morton,	= Cypricardia testacea, Zit.
"	7.	"	7.	Vetericardia, Con.	= Cardita granigera, Gümp.
"	10.	"	1.	Trigonoarca, Con.	= Cucullæa Austriaca, Zit.
"	"	"	2.	Trigonoarca,	= Cucullæa crossetesta, Zit.
"	"	"	3.	Idonearca,	= Cucullæa Chiemiensis, Gümp.
"	"	"	4.	Trigonoarca,	= Cucullæa gosauviensis, Zit.
"	"	"	5.	Trigonoarca,	= Cucullæa bifasculata, Zit.
"	"	"	6.	Trigonoarca,	= Cucullæa semisulcata, Math.
"	"	"	7.	Trigonoarca,	= Arca Swabeani, Zit.

After an examination of Stoliczka's "Palæontology of Southern India," I would suggest the following rectification of generic names contained therein:—

	Vol. II.			
Plate	II.	2–4.	Anchura, Con.	= Aporrhais securifera, Forbes.
"	"	5–8.	Anchura,	= Alaria Parkinsoni, Mant.
"	"	9–10.	Anchura,	= Alaria papilionacea, Goldf.
"	"	11–13.	Anchura,	= Alaria tegulata, Stol.
"	"	14–15.	Anchura,	= Alaria glandina, Stol.
"	"	16–17.	Anchura,	= Alaria acicularis, Stol.
"	VIII.	4–7.	Ptychoris, Gabb,	= Athleta purpuriformis, Forbes.
"	"	8.	Ptychoris,	= Athleta scrobiculata, Stol.
"	XII.	2.	Pyropsis, Con.	= Rapa Andoorensis, Stol.
"	"	5–8.	Pyropsis,	= Tudicla eximia, Stol.
"	"	10–11.	Pyrifusus, Con.	= Rapa nodifera, Stol.
"	"	12–16.	Pyropsis,	= Rapa cancellata, Sow.
"	XIII.	1–4.	Pyropsis,	= Rapa cancellata, Sow.
"	"	5.	Pyropsis,	= Rapa corallina, Stol.

Vol. III.

Plate	I.	12–13.	Leptosolen, Con.	= Siliqua limata, Stol.
"	II.	8-9.	Liopistha,	= Poromya lata, Forbes.
"	"	10–11.	Liopistha,	= Pholadomya caudata, Röm.
"	"	8.	Liopistha,	= Poromya globulosa, Forbes.
"	III.	2–4.	Liopistha, Meek,	= Poromya superba, Stol.
"	IV.	3.	Legumen, Con.	= Tagelus Albertinus, d'Orb.
"	VI.	1-5.	Cyclothyris, Con.	= Cyprimeria Oldhamiana, Stol.
"	"	17–19.	Aphrodina, Con.	= Cytherea Garudana, Stol.
"	VII.	7-9.	Aphrodina,	= Cytherea (Callista) laciniata, Stol.
"	"	10-17.	Aphrodina,	= Cytherea lascula, Stol.
"	"	18–20.	Aphrodina,	= Cyth. (Callista) minutula, Stol.
"	"	21-23.	Aphrodina,	= Cyth. (Callista) vagrans, Stol.
"	"	30-31.	Aphrodina,	= Cyth. (Callista) discoidalis, Stol.

VENIELLA, Stol.

As Stoliczka has without sufficient reason given this name in preference to that of *Venilia*, Morton, and as his first reference is to that of another genus, it may stand as the type of *Veniella*.

Plate	VIII.	4–9.	Veniella (Venilicardia) obtruncata, Stol.	
"	IX.	1.	Venilia, Morton.	=Cyprina cristata, Stol.
"	"	2-8.	Venilia,	=Cyprina Forbesiana, Stol.
"	X.	1-2.	Venilia,	=Cyprina (Cicatrea) cordialis, Stol.
"	"	15–21.	Cretocardia, Con.	=Cardita Jaquenoti, d'Orb.
"	XVI.	16.	Liopistha, Meek,	=Poromya globulosa, Forbes.
"	"	17.	Liopistha,	=Poromya lata, Forbes.
"	XVII.	1-2.	?	Cyprimeria obesa, d'Orb.
"	XVIII.	6-11.	Idonearca, Con.	=Macrodon (Grammatodon) Japeticum, Forbes.
"	XXIV.	2.	Inoperna, Con.	=Modiola flagellifera, Forbes.

Regarding the generic names in Dr. Zekeli's paper on the Gasteropoda of the Gosau strata, I would propose the following:—

Plate	XII.	4.	Anchura Con.	— Rostellaria calcarata, Sow.
"	XIII.	1.	Anchura,	— Rostellaria Partschi, Zk.
"	XIV.	5.	Rostellites, Con.	— Voluta prolonga, Zk.

NOTES ON SHELLS.

BY T. A. CONRAD.

CRYPTODON, Con.

C. Nuttallii, Con.

Lutraria maxima, Midd.
Schizothærus Nuttallii, Con.
Tresus maximus, Gray.

This shell, described in 1837, should retain the generic name of *Cryptodon*, as Gray has published it, because the *Cryptodon* of Turton, 1822, was superseded by *Thyasira*, Leach, 1818. The latter genus was established by the quotation of Lamarck of *Thyasira* under the head of *Tellina flexuosa*, the type of *Cryptodon*, Turton. Gray afterwards names the *Lutraria maxima* of Middendorf *Tresus;* but Carpenter and others unite the latter with *Cryptodon Nuttallii* by means of great numbers of specimens of both varieties. The synonymy will therefore be as above.

GLYCIMERIS, Klein.

Panopæa, Menard de la Groye, is a synonym of this genus, as stated by Adams, but some conchologists have supposed that Klein's figure represented *Cyrtodaria*, Daudin. The figure is larger than *Cyrtodaria*, of the *Glycimeris* outline, and especially the habitat, according to Bonani in "Iberico mari," is not that of the arctic *Cyrtodaria*. The second species of Klein is *Chama glycimeris*, Aldrovandi, "ex mari Hispanico" (*Panopæa Aldrovandi, Lam.*).

Panomya, Gray, is the generic name for *Panopæa*.

CYMBOPHORA, Gabb.

This genus appears to characterize the upper Cretaceous strata in California, New Jersey, and North Carolina, leaving no successor in the Eocene. I had supposed it differed in some respects from *Veleda*, Conrad, but I am now convinced that it is essentially the same genus. I may add to Gabb's description that the palleal line has a small rounded sinus.

Cymbophora lintea, Conrad.

Veleda lintea, Conrad.

SCAMBULA, Conrad.

Mr. Gabb has referred this singular genus, of the family *Crassatellidæ*, to his *Anthonya*, in which opinion I do not agree. *Anthonya* is a bent shell, the other is not; while the former has no lateral teeth, the other has two long linear lateral teeth.

UNIONIDÆ OF OHIO AND ALABAMA.

BY JAMES LEWIS, M.D.

In the Ohio River and its tributaries are found a very considerable number of species of Unionidæ, a large proportion of which are regarded as types by means of which similar shells of other regions are identified. In Central Alabama occur about thirty species of Unionidæ that are identical with or equivalent to a similar number of species of the Ohio drainage. Possibly an exhaustive study of the species of Tennessee would increase this list to forty or more species. The occurrence of identical and equivalent species in the two systems of drainage suggests the probability that a careful scrutiny of some of the *equivalent* species may afford some assistance in simplifying the study of these things by indicating synonymy hitherto unsuspected. The identical species of the two regions, so far as have been compiled, are embraced in the following list:—

Unio Anodontoides, Lea.	**U. obliquus, Lam.**
U. camptodon, Say.	**U. plenus, Lea.**
U. cornutus, Barnes.	U. pyramidatus, Lea.
U. crassidens. Lam.	U. rectus, Lam.
U. ebenus, Lea.	U. securis, Lea.
U. elegans, Lea.	U. tuberculatus, Barnes.
U. metanever, Raf.	Margaritana complanata, Barnes.

Of the shells common to the Ohio and Alabama drainage it may be unnecessary to speak at length of more than one species, *U. crassidens*, Lam., which may be considered the type of a somewhat numerous group of species of shells of solid structure, dark epidermis, dark purple nacre, and having folds more or less strongly indicated on the posterior slope. The following are some of the more prominent members of the group:—

U. pliciferus, Lea. Mexico.	U. Monroensis, Lea. Lake Monroe, Florida.
U. incrassatus, Lea. Chattahoochee River, Ga.	U. Forbesianus, Lea. Savannah River, Ga.
U. fraternus, Lea. Chattahoochee River, Ga.	etc. etc. etc.
U. Anthonyi, Lea. Florida.	

The distribution of *crassidens* seems to extend to many of the more conspicuous rivers of the Gulf States west of Florida; to all

the principal tributaries of the Ohio. Most of the other recognized species of this group are quite local, and do not occupy an extensive area. There are in this group indications that the future student of synonymy may find much to interest him.

Unio fraternus, Lea, appears to be simply a variety of *incrassatus*, as intermediate specimens of every degree seem to be abundant in the Chattahoochee River.

Among the most conspicuously *equivalent* species are the following:—

Ohio System.	Alabama System.
U. alatus, Lea.	U. purpuratus, Lamarck.
U. brevidens, Lea.	U. penitus, Con.
U. circulus, Lea.	U. castaneus, Lea.
U. clavus, Lamarck.	U. decisus, Lea.
	U. interventus, Lea.
	U. consanguineus, Lea.
	U. crebrivittatus, Lea.
	U. Chattanoogaënsis, Lea.
U. Conradianus, Lea.	U. acutissimus, Lea.
	U. parvulus, Lea.
	U. rubellinus, Lea.
U. Cooperianus, Lea.	U. asperatus, Lea.
U. gibbosus, Barnes.	U. subgibbosus, Lea.
	U. sublatus, Lea.
U. glans, Lea.	U. Cromwellii, Lea.
	U. corvunculus, Lea.
U. Kirtlandianus, Lea.	U. glandaceus, Lea.
	U. verus, Lea.
	U. instructus, Lea.
U. lachrymosus, Lea.	U. asper, Lea.
U. lævissimus, Lea.	U. inflatus, Lea.
U. lenoir, Lea.	U. metastriatus, Con.
	U. compactus, Lea.
U. luteolus, Lam.	U. stramineus, Con.
	U. Claibornensis, Lea.
	U. pallescens, Lea.
	U. Gouldii, Lea.
U. multiplicatus, Lea.	U. Boykinianus, Lea.
U. ovatus, Say.	U. excavatus, Lea.
U. parvus, Barnes.	U. granulatus, Lea.
	U. germanus, Lea.

Ohio System.	Alabama System.
U. phaseolus, Hildreth.	U. Greenii, Lea.
	U. flavescens, Lea.
	U. simplex, Lea.
	U. trinacrus, Lea.
	U. Foremanianus, Lea.
	U. Woodwardianus, Lea.[1]
U. plicatus, Barnes.	U. atro-costatus, Lea.
	U. Elliottii, Lea.
U. rubiginosus, Lea.	U. negatus, Lea.
U. undulatus, Barnes.	U. late-costatus, Lea.

On comparing the shells of the two regions indicated, it will be found generally true that the shells of the Ohio system, especially of that portion north of the Ohio River, attain a more luxuriant development and have a more brilliant epidermis, in which the rays are more numerous and more persistent, than in the shells of Alabama. There are also conspicuous differences in form, even in some of the species that are acknowledged to be identical in the two regions.

Some of the species that are here presented as equivalents of species of the Ohio system are represented by other analogous forms or equivalents in contiguous territory in the same latitude with Central Alabama.

Unio purpuratus extends westward into Texas and Arkansas. So far as known *U. penitus* has been reliably quoted only as found in the Alabama River, possibly also in the Coosa River, which is practically the same thing. *Unio decisus* is said to occur in Mississippi as well as in Alabama. *Unio consanguineus*, *U. crebrivittatus* and *U. Chattanoogaensis* are quoted as found in Georgia and Alabama. The equivalents of *U. Conradianus* have been quoted as occurring in several streams in Alabama. One, *U. rubellinus*, also occurs in Georgia. Another, not included in the above list (*U. penicillatus*), is found in the Chattahoochee River.

A shell of this type also occurs in the Black Warrior River, in which stream also occur other Uniones, whose geographical distribution is nearly the same. The range of the shells of this type in Alabama and Georgia reaches fully across the State of Alabama. Whether similar shells are also found in the rivers of Mississippi does not appear in any records that have been consulted

[1] Georgia.

in the preparation of this paper. Through correspondence and records the distribution of *U. Conradianus* is found to reach the northern portions of Georgia and Alabama, a considerable portion of East Tennessee, and a few streams in Kentucky.

Unio Cooperianus, Lea, besides finding an equivalent in *U. asperatus*, seems also to be represented elsewhere in the same or a similar manner by *U. pernodosus*. *U. asperatus* occurs in the Coosa, Alabama, and Black Warrior Rivers, in each of which streams it exhibits local peculiarities, more marked, perhaps, in the Black Warrior River than in the other two streams named.

Unio gibbosus, Barnes, is very fairly represented in the Coosa River by shells having white nacre to which Mr. C. M. Wheatley, of Phœnixville, Pa., gives the name *U. subgibbosus*, Lea. Whether this nomenclature has the sanction of Mr. Lea has not been stated. The typical *U. sublatus* is found in Uchee Creek, in southeastern Alabama, and also on Uchee Bar in the Chattahoochee River. Specimens identified by records and types have been found in Shoal Creek at Montevallo, Ala. The beaks of the Shoal Creek specimen have undulations such as are found on the perfect beaks of young *gibbosus*. In another stream near Montevallo (Buck Creek) is found another variety more slender in form, with darker epidermis and nacre, and more decided undulations in the beaks. In the series of specimens that have been examined as recorded above, the near relation of *U. sublatus* to *gibbosus* is very clearly shown. Of *Unio glans*, *Cromwellii* and *corvunculus* little can be said at this time for the reason that but few specimens from any one locality have been examined in this connection. The two species last named occur at Montevallo and in Northern Georgia.

The shells quoted as the equivalents of *U. Kirtlandianus* occur in the Cahawba River and in Buck Creek. Mr. Lea quotes only the Cahawba River. The shells are very much alike, the chief differences seeming to be due to age and local influences. They have much the same flattened form as *Kirtlandianus*, and the undulations on the beaks of the young shells are such as occur in *Kirtlandianus;* in outline there are conspicuous differences, though the Alabama shells agree very closely with each other in form character of the epidermis, muscular and palleal impressions, teeth and nacre.

In the relation of *U. asper* to *U. lachrymosus* differences may be observed which are, in many respects, such as might be pointed

out in some of the species of Alabama identical with Ohio species. Many of the Alabama Uniones that are identical with Ohio species exhibit peculiarities that one readily and intuitively ascribes to local influences. Some of them are of smaller *size;* those species which in Ohio are beautifully and conspicuously marked with rays, in Alabama are found without rays, or the rays appear only on the umbo and are lost by erosion as the shell matures. In other instances the rays appear only as a periodical phenomenon, a row of distant spots down the posterior angle, disappearing before they reach the margin of the adult shell. This phenomenon is faintly hinted in many of the shells of Tennessee, and makes its full appearance only in Georgia, Alabama, and other States in the same latitude. Local influences must affect every species in a greater or less degree.

In quoting *asper* as an equivalent of *lachrymosus* the parallelism is suggested and verified by specimens of *lachrymosus* from the Illinois River. In these specimens the forms and colors, and other peculiarities of *asper*, are approximated in a very suggestive manner. The Illinois shells, however, though smaller than Ohio River shells, are larger than the typical *asper*. *U. asper* itself varies in different localities, and among its most prominently variable features are its *size* and roughness of surface. The relations of *asperrimus* to these shells seem to require that it be *mentioned* here. *Unio lævissimus* and *U. inflatus* are obviously nearly related. The chief and most conspicuous difference is in the relative diameter of the two shells.

Unio lenior, quoted by Mr. Lea as a Tennessee shell, seems to be represented in the Black Warrior River by the female of a small species belonging to the same group with *U. penitus*, Con. Shells recently received from the Black Warrior fully corroborate Mr. Lea's remark on *U. metastriatus*, Con., at the bottom of page 40 in his Synopsis of 1870, and make its identification complete.[1] This is the female of the same species to the male of which Mr. Lea gave the name *U. compactus*. It has been found in the Black Warrior, Cahawba, and other rivers and creeks in Alabama. Mr. Lea's type of *compactus* was from Georgia. The shells vary from each other in different streams, as is the universal habit of this class of mollusks.

[1] Conrad's *metastriatus* is a Black Warrior River shell.

Unio luteolus, Lam., does not seem to have been recorded as occurring in any stream much south of the latitude of the Ohio River.[1] It may possibly occur in some of the rivers of Kentucky; it is regarded as one of the most variable species occurring in water north of the Ohio. A lacustrine variety described by Mr. Anthony received the name *U. distans*, Anth.

Mr. Lea in his Synopsis (1870) has put *distans* in the synonymy of *radiatus*. The error was probably accidental. In southern latitudes the typical *luteolus* is unknown,[2] and in its place are found equivalents to which the following names and local references have been assigned:—

Unio obtusus, Lea. Chattahoochee River, Ga.
U. Claibornensis, Lea. Alabama River, Ala.
U. stramineus, Con. Various small streams in Alabama, etc.
U. pallescens, Lea. Black Warrior River, Ala.
U. Gouldii, Lea. Tuscaloosa, Ala.
U. approximus, Lea. Red River, La.
U. Reeveianus, Lea. Alexandria, La.
U. Hydianus, Lea. Bayou Teche, La.

In the progress of the investigations made in this behalf, specimens of this group of shells have been carefully compared, and a liberal interpretation has been given to records of species.

It has been suggested that *Unio callosus*, Lea, may find a fitting place in the above list of equivalents of *luteolus*. Of the value of *callosus* as a species, nothing is known beyond the record. The relations conjectured between *U. multiplicatus* and *U. Boykinianus* may not be confirmed. Between *U. multiplicatus* and *U. Eightsii* from Texas, relations are more apparent. *U. Boykinianus* has a somewhat wide distribution, being known to occur in the Alabama and Tombigbee Rivers as well as in the Chattahoochee. Possibly specimens may yet be found in Louisiana and Texas, to make its relation with *multiplicatus* more apparent.

Unio ovatus, Say, has probably more intimate relations with southern shells of the same type than the differences in names would imply. *U. excavatus*, Lea, found in Mississippi, Alabama, and Georgia, is represented in the Chattahoochee River by a diminutive form of the same type. The typical *ovatus* is a triangularly ovate shell, posteriorly truncate, with epidermis nearly devoid of

[1] *U. luteolus* is quoted from Texas, Obs. XI. 31.
[2] See Obs. XI. 31.

rays. A slightly more rotund form having rays and often pink nacre is Mr. Barnes's *U. ventricosus*. A form still more rotund is Mr. Lea's *U. occidens*, the male of which many intelligent collectors believe to be his *subovatus;* while *U. capax*, Green, is a very globose shell, scarcely marked with rays, and having the cardinal teeth very much compressed and directed obliquely forward, nearly parallel with the anterior dorsal margin of the shell. *Unio satur*, Lea, seems to be very nearly related to *capax*. *Unio Canadensis*, Lea, is apparently very nearly related to *occidens*. It differs by being quite as much compressed as *U. carinosus*, and nearly of the same form. The beaks are more coarsely undulate than in any other shell of this group. *U. Canadensis* is probably a northern equivalent of *occidens*. It occurs in Wisconsin as well as in the river St. Lawrence.

Uniones of the type of U. parvus, Barnes. There are on record nineteen species of Uniones which have relations to each other seeming to warrant their association in this group. In geographical distribution they extend over a large area north and south in the United States and both sides of the Mississippi River. The typical *parvus* is known to exhibit considerable diversity of appearance, form, and size. One variety of this species found in Indiana is so remarkable for its luxuriant development as to have acquired the familiar designation of "The big parvus of the Wabash." This variety differs also from the type by having the nacre sometimes tinted of a salmon color, the nacre of the type being white. Most of the species of this group also have white nacre. Two, however (possibly having more intimate relations with *U. glans*, Lea), have purple nacre. These are the species *Cromwellii* and *corvunculus*. Another species has been characterized as having salmon-colored nacre, namely, *U. Bealei*. Two other species, clearly members of this group, have been described as having "purplish" nacre; these are *granulatus* and *germanus*. The soft parts of three species have been found to exhibit, near the branchial opening, a black, spongy, fleshy mass that Mr. Lea calls "caruncle." This has been observed only in females of *parvus*, *granulatus*, and *paulus*. The differences of form usually observed in the sexes are less conspicuously observable in *parvus* (as found in the Ohio system of drainage) than in some of the other species of this group. *Unio pygmæus* is probably figured from a male specimen; the female may possibly have the form of

granulatus. Shells from North Carolina distributed by Mr. C. M. Wheatley to his correspondents under the name of *granulatus* seem to warrant this conjecture.

That Mr. Lea regards some of the forms included in this group as being possibly synonyms of others, is indicated in his Synopsis, 1870, p. 49, foot note 3; and also in his remarks on species in "Observations" VIII., 41 and 43.

Two species, members of this group (*paulus* and *corvinus*), are credited to the Chattahoochee and Flint Rivers in Georgia. It should be remembered that these two streams are parts of one system of drainage, and that they have many species of Uniones in common.

The species *Johannis* and *flavidulus* may ultimately prove not to be legitimate members of this group, as they exhibit peculiarities of form in which they resemble each other, while they are in some respects quite different from all the other species with which they are here provisionally associated.

In compiling notes on a group of species, it might by some persons be thought excusable to suggest synonymy in those instances in which strong resemblances are apparent. But synonymy is not to be hastily inferred, as there are also *differences*, some of which are too important to be ignored. The most that can be done at present is to call attention to *groups of species* in a manner to encourage a thorough study of them. It seems also necessary that inquiries should be directed particularly to geographical distribution and the local association of species; also to the local influences that modify species, and to the extent to which a species may be susceptible to modifying influences. Synonymy and the hypothesis of evolution may contend for the result in the final treatment of this and other groups of Uniones. To aid the student who may desire to know what has been recorded of the group of species now under consideration, the following table of references is appended:—

Unio parvus, *Barnes*. Ohio, etc.[1] American Jour. Sci. 1823. Lea's Observations—(soft parts) VII. 39; (Embryos) VII. 39; (Miscellaneous References) I. 23, 26, 27, 34, 54, 97, 213; II. 55, 128; III. 52, 69, 70, 85; IV. 35; V. 18, 25; VI. 20; VIII. 44, 101; IX. 27; XI. 24, 31, 54; XII. 15, 19, 69, 71, 75, 87; XIII. 42.

[1] Besides having been found in the Ohio River and its tributaries, Mr. Lea in his "Observations" quotes *parvus* as occurring in Mississippi (VII. 39) and in Texas (XI. 31).

U. granulatus, Lea. Big Prairie Creek, Ala. Jour. Acad. Nat. Sci. VI. 48; Obs. XI. 52: Synopsis, 1870, p. 49, foot note 2.

U. germanus, Lea. Coosa River, Ala. Jour. A. N. S. VI. 49; Obs. XI. 53; (soft parts) XI. 54; (Miscell. Ref.) XII. 45.

U. paulus, Lea. Chattahoochee River, Ga. Trans. Am. Phil. Soc. VIII. pl. 15, f. 29; Obs. III. 51; (soft parts) X. 38; (Embryo) VII. 40; X. 39; (Miscell. Ref.) VIII. 26; XII. 19, 71, 75.

U. corvinus Lea. Flint River, Ga. Jour. A. N. S. VI. 310; Obs. XII. 70.

U. Johannis, Lea. Connasauga River, Ga.; Etowah River, Ga.; Alabama River, Ala. Jour. A. N. S. IV. 343; Obs. VIII. 35.

U. flavidulus, Lea. Columbus, Miss. Jour. A. N. S. V. 97; Obs. VIII. 101.

U. Texasensis, Lea. DeWitt Co., Texas. Jour. A. N. S, IV. 359; Obs. VIII. 41.

U. Bairdianus, Lea. Devil's River, Texas. Jour. A. N. S. VI. 361; Obs. VIII. 43.

U. Bealei, Lea. Leon Co., Texas. Jour. A. N. S. V. 304; Obs. IX. 26.

U. corvunculus, Lea. Swamp Creek, Whitfield Co., Ga. Jour. A. N. S. VI. 315; Obs. XII. 74.

U. Cromwellii, Lea. Kiokee Creek, Dougherty Co., Ga. Jour. A. N. S. VI. 258; Obs. XII. 18.

U. marginis, Lea. Blue Springs, Dougherty Co., Ga. Jour. A. N. S. VI. 255; Obs. XII. 15.

U. apicinus, Lea. Othcalooga Creek, Gordon Co., Ga. Jour. A. N. S. IV. 76; Obs. VI. 76.

U. ineptus, Lea. Abbeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 12, Obs. V. 17; XI. 25.

U. pygmæus, Lea. Abeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 14; Obs. V. 18.

U. vesicularis, Lea. Lake Ocheechobee, Florida. Jour. A. N. S. VIII.; Obs. XIII. 41.

U. minor, Lea. Lakes Monroe and George, Florida. Trans. Am. Phil. Soc. IX. pl. 39, f. 8; Obs. IV. 34.

U. trossulus, Lea. Lake Monroe, Florida. Trans. Am. Phil. Soc. IX. pl. 40, f. 6; Obs. IV. 36.

Unio phaseolus, Hildreth, as found in northern waters, presents considerable diversity of form and appearance, but nowhere loses its identity north of the Ohio. In the Indian Territory varieties are found which exhibit peculiarities which might puzzle an inexperienced student. Something similar has been found in some of the streams near the southwestern part of Tennessee. In these divergent specimens the characteristic form of the species becomes somewhat obscured, and the rays are capillary. They diverge, indeed, from the typical *phaseolus* in the direction of its southern equivalents, as exhibited in the rivers of Alabama.

Unio velatus, Conrad, which Mr. Lea puts in the synonymy of *Foremanianus*, is quoted from "the river St. Fois." Mr. Conrad makes *U. simplex*, Lea, a synonym of *U. Greenii*, Con. Mr. Lea, in his Synopsis (1870), foot note 1, page 43, is evidently of the opinion that *U. Greenii* and *U. flavescens* are varieties of one species; an opinion that is clearly entitled to the highest consideration. It is possible that some future writer may be able to show that *all* the Alabama equivalents of *phaseolus* are entitled to be placed in the same category with *Greenii* and *flavescens*.

Unio plicatus, Barnes,[1] has a considerable number of southern equivalents, besides the two quoted for Alabama.

Southern equivalents of *U. plicatus*, Barnes, and original localities.

U. perplicatus, Con. Jackson, La.
U. atro-costatus, Lea. Claiborne, Ala.
U. Elliottii, Lea. Othcalooga Creek, Geo.
U. Lincecumii, Lea. Dallas Co., Texas, and Brazos River, Texas.
U. Brazosensis, Lea. Dallas Co., Texas.
U. pauciplicatus, Lea. Austin, Texas.

Unio hippopæus, Lea, Lake Erie, seems to be a northern lacustrine form, entitled to a place as a member of the group.

U. perplicatus, Con., has a somewhat extensive geographical distribution, and is a very well-known shell. *U. atro-costatus*, Lea, which is sometimes confounded with *perplicatus*, occurs in the Coosa River. Specimens referable to this species have been taken in the Cahawba.

U. Elliottii, Lea, seems to be represented in the Cahawba River by shells of the characteristic *form*, but of less size than the type. Shells that would be quite readily identified as *U. pauciplicatus*, Lea, occur in the Upper Black Warrior River.

Of *U. negatus*, Lea, not much needs to be remarked. The species is set apart from *rubiginosus*, Lea, out of regard to the peculiar undulations of the beaks. The beaks of different varieties of *rubiginosus* exhibit considerable diversity of appearance. The species is very widely distributed, and assumes a wonderful variety of forms.

U. undulatus, Barnes, is represented in Alabama by *U. latecostatus*, Lea, which is credited by Mr. Lea to Tuscaloosa. Shells

[1] Mr. Barnes was the first person to describe *U. plicatus*, though it had been on record, without description, earlier.

of this type occur in various streams in the vicinity of Selma and Montevallo. Cahawba River, Buck Creek, and Bogue Chitto Creek, are among those remembered. One adult specimen from Bogue Chitto Creek has the characteristic folds, but not the form of a smaller shell of this group (*U. Neislerii*, Lea) found in Flint River, Georgia. While the subject is yet fresh, it may not be out of place to inquire whether *U. undulatus* is other than an equivalent of *plicatus*? Do the two forms maintain their integrity? And is there any well-attested instance of their occurring in one locality together, each preserving its identity?

Referring back to *U. plicatus* and its equivalents, more especially to those in which the folds have become nearly or quite obsolete, it may not be out of place to remark that there is a specimen of unmistakable *plicatus* from the Ohio River, in the National Museum at Washington (Smithsonian Institution), *entirely destitute of folds*.

FEBRUARY 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

FEBRUARY 13.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The following papers were presented for publication:—

"On the Fishes of Northern Indiana." By D. S. Jordan.

"On the Genera of North American Fishes" By D. S. Jordan and Charles H. Gilbert.

"List of Plants recently collected on Ship's Ballast in the Neighborhood of Philadelphia." By Isaac Burk.

In conformity with Art. III. Chap. V. of the By-laws, W. S. W. Ruschenberger, E. Goldsmith, Persifor Frazer, Jr., Jos. Leidy, Geo. A. Koenig, H. C. Humphrey, C. P. Krauth, Wm. H. Dougherty, R. S. Kenderdine, Henry C. Chapman, Alexander Willcocks, and W. G. Platt were constituted the Physics and Chemistry Section of the Academy of Natural Sciences of Philadelphia.

FEBRUARY 20.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-six members present.

The deaths of Mr. William Struthers, Dr. Elisha J. Lewis, and Dr. Wm. Byrd Page were announced.

Art. 8, Chap. I. of the By-laws was amended by adding the words, "Provided that no professor or assistant-professor in the Academy shall occupy the position of councillor—those who are ex-officio members of council excepted."

On the Giraffe.—Dr. H. C. CHAPMAN remarked that, in a verbal communication on the post-mortem examination of a Giraffe, in the Proceedings for 1875, page 401, he described and figured the mode of origin of the great bloodvessels from the arch

of the aorta. Having lately had the opportunity of dissecting another specimen which died in the Zoological Gardens of this city, he called attention to a slightly different disposition of these vessels. In this case an innominate gave off the right subclavian, right vertebral, the left subclavian, and left vertebral separately, and then terminated in the two common carotids. This arrangement also differs from that described by Prof. Owen, thus illustrating the variability in the origin of the bloodvessels in these animals. The recurrent laryngeal nerve was found as described by the eminent anatomist just mentioned, that is, the lower two-thirds almost completely atrophied, while the upper third came from the pneumogastric just below the superior laryngeal.

On the Habits of Quiscalus purpureus.—JOSEPH WILLCOX spoke of the custom of some crow blackbirds (*Quiscalus purpureus*) of eating fish, and their method of catching them through the intervention of another animal.

Last winter when on the shore of the St. John's River, near Lake Jessup, in Florida, he observed an unusual commotion among the crow blackbirds, which were congregating near the water, and anxiously looking into it. Soon a loud splash and noise were made in the vicinity by a large bass in making a charge upon his favorite food, the small fry, which, in their frantic efforts to escape, jumped out of the water, and many of them fell upon the land.

The blackbirds, which were evidently experts at the game, immediately pounced upon the small fish and swallowed them before they had time to hop back into the water. This performance was repeated many times.

On one occasion he examined the stomach of a bass in order to ascertain what it had taken for dinner. In it he found a rat that had evidently been imprisoned only a short time.

FEBRUARY 27.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-two members present.

Frank L. Scribner and Mrs. Mary Wagner were elected members.

Prof. Alphonse Favre of Geneva, Prof. Paul De Loriol of Geneva, Baron Ferdinand Freiherrn Von Richthofen of Berlin, Dr. Ferd. Von Hochstetter of Vienna, Prof. Edouard Desor of Neuchatel, Prof. Ludwig Rütimeyer of Basel, Prof. Valerien De Mueller of St. Petersburg, H. Trautschold of Moscow, and Lieut. A. W. Vodges, U. S. A., were elected correspondents.

The following papers were ordered to be printed:—

ON CERTAIN EXCREMENTITIOUS DEPOSITS FOUND IN THE WEST.

BY H. W. HENSHAW.

In the volume on Zoology, forming one of Lt. Wheeler's reports to the chief of engineers, several pages are devoted to a discussion of the origin of certain resinous-like substances, found in the crevices and on the walls of many of the rocky cañons of the far west, and the conclusion arrived at that these were the excrementitious products of a species of lizard, *Euphryne obesa*. This opinion chiefly resulted from the fact, ascertained by chemical analysis, that these products were composed wholly of vegetable matter; in view of which fact the original supposition that they had been made by bats was abandoned, the diet of these animals being, as is well known, insectivorous. Hence their origin was attributed to the herbivorous lizard above mentioned, the inaccessibility of many of the spots where the substance was noticed being deemed sufficient proof to negative the possibility of its originating from any other mammal. In a note following, however, it is stated that Prof. Cope believes this excrement to have been produced by some small mammals, as the *Neotoma*.

As a matter of interest to some, and inasmuch as I learn that the subject has again been brought to notice by the receipt of similar specimens by the Academy of Natural Sciences of Philadelphia, which were made the subject of remarks at one of the Society's meetings, I propose offering a few suggestions regarding these deposits, especially since I believe I can speak with some degree of positiveness as to their origin.

During the past season, while in the neighborhood of Lake Tahoe, Cal., I had an opportunity of examining deposits of an exactly similar character, and under circumstances which admit of no doubt in my own mind that their originators are the big-eared rats (*Neotoma*), as believed by Prof. Cope.

My attention was directed to these deposits by Mr. H. G. Parker, of Carson City, Nevada, who stated, that, when visiting Cave Rock, on the borders of Tahoe, some ten years before, he had found the depressions and crevices of the rock to be inhabited by large numbers of a rat, which he described as having large ears

and a bushy tail. These characteristics point with certainty to a *Neotoma*, probably *N. cinerea*.

Incidentally he mentioned the "bituminous-like" deposits, the origin of which he was at a complete loss to understand, but which he finally satisfied himself were the product of these rats. Visiting the place myself, I found the deposits as described, but was unable to obtain any proof of the presence of the rats. It is possible they were still there, but, it being daytime, had hidden away in the remote crevices; or, as is quite probable, that their former haunt is now deserted. In either case the fact of their former occupation of the place in numbers, as attested by Mr. Parker, is sufficient.

The deposits here vary much in character, and, as any attempt to describe them in detail would occupy too much space, I will mention them briefly.

Specimens gathered from different parts of the rock showed all the differences between the hard, rounded, pill-like excrements, which no one could mistake the nature of, and the hardened bituminous substances, in mass, which bears no resemblance at all to excrement. The former is found on the flat shelves of rock, where, however, it is often partially dissolved by action of the urine, and perhaps too by water. In this form it is not readily recognizable, but a careful examination will show the rounded excrements through the whole mass, especially if it be broken.

In one case I found a crevice which had been filled up to the depth of at least two feet, with the stalks of weeds, small twigs, and even with a considerable amount of bird's feathers interspersed. This mass was evidently the accumulation of years, and had served as a nest. Throughout was a large amount of dry hard droppings, from which the urine had passed, and which was unmistakable. The urine charged with a certain amount of excrementitious matters had filtered through, to form below the singular deposits.

The "conglomerate masses" then are simply the excrement dissolved by urine, and carried from the original place of deposit in crevices or on shelves by water, or possibly by urine itself, if in sufficient quantity, and deposited on the faces of the walls, where it is perfectly true no animal without wings could reach; and in many cases, it might be added with equal truth, could not deposit the masses if they could reach the spot, inasmuch as they are

sometimes found on the *roof* of a hollow rock where they trickle from above.

This will account for the presence of the substance many feet away from the place where first deposited.

Finally, all the regions in which these masses of excrement are found are known to be inhabited by the *Neotoma*. The chemical analysis of these deposits made by Dr. Loew is also entirely in accordance with such an origin, as the *Neotoma* is eminently a vegetarian. Some of the deposits are unquestionably of great age, and the particular localities may or may not be inhabited at the present time by the rats. In many cases they certainly are not, as the erosion and breaking away of masses of the cliffs has in many instances rendered inaccessible points which formerly permitted free access.

ON THE FISHES OF NORTHERN INDIANA.

BY DAVID S. JORDAN, M.D.

The material on which the present paper is based was collected, in the summer of 1875, in the streams and clear, deep lakes of the northern part of Indiana, by Mr. Caleb Cooke, in the interest of the Peabody Museum of Science, and Dr. G. M. Levette, in the interest of the Indiana Geological Survey.

The collection consists chiefly of small fishes—darters, sunfish, and minnows—with the young of some larger species. About 60 species in all are represented.

The following are the localities:—

I. Lakes without outlet to the sea.
   - *a.* Clear Lake, La Porte Co.
   - *b.* Pine Lake, La Porte Co.

II. Waters tributary to Lake Michigan through St. Joseph's River and its branch, the Elkhart.
   - *a.* South Fork of the Elkhart, Rome City, Noble Co.
   - *b.* Tamarack Run, two miles south of Rome City.
   - *c.* Adams Lake, La Grange Co.
   - *d.* Stream at Syracuse, in Kosciusko Co.

III. Waters tributary to Lake Erie through the Maumee River and its branch, "St. Joseph's of the Maumee."
   - *a.* Henderson Lake and Creek, Kendallville, Noble Co.
   - *b.* Sawyer Creek, outlet of Long Lake, Kendallville.
   - *c.* Outlet of Bixel's Lake, Kendallville.

IV. Waters tributary to the Illinois River through Kankakee River.
   - *a.* Mill-pond and Creek, Union Mills, La Porte Co.

V. Waters tributary to the Upper Wabash through Tippecanoe River.
   - *a.* Lake Manitou, Rochester, Fulton Co.
   - *b.* Centre Lake, Warsaw, Kosciusko Co.
   - *c.* Lake Tippecanoe, Kosciusko Co.

VI. The Lower Wabash (Coll. F. W. Putnam, 1871).
   - *a.* Wabash River, Hutsonville, Crawford Co., Illinois.
   - *b.* Wabash River, Merom, Sullivan Co., Ind.
   - *c.* Turman's Creek, Sullivan Co.
   - *d.* A few specimens in my own collections from Terre Haute, Vigo Co.

For purposes of comparison I add:—

VII. White River and its tributaries—Fall Creek, Eagle Creek, Pleasant Run, and Pogue's Run—in the neighborhood of Indianapolis, in Marion Co.; and Hurricane Creek, in Johnson Co. (Collections of Prof. H. E. Copeland and myself in 1874-77).

It will be noticed that, excepting Nos. VI. and VII., the above-mentioned localities are near together, all within a radius of 50 miles, but on five different sides of the water-shed of northern Indiana. A glance at the table below will show, however, that, in all these upland streams and lakes, the fish-fauna is essentially the same, although in some cases the waters flow to the Gulf of Mexico, in others to the Gulf of St. Lawrence. On the other hand, between the faunæ of the upper course of the Wabash River and that of the lower, and between both and the fauna of White River, there will be noticed certain striking differences.

These facts may be formulated as follows: More species of fishes are common to the head-waters of streams rising on different sides of a water-shed than are common to the upland and lowland courses of the same stream. This subject is ably discussed by Prof. Cope (Journ. Acad. Nat. Sci., Phil., 1868, 242-246).

In the following table are given, opposite the name of each fish, the number of specimens thereof in the collection from each of the different water-basins:—

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
PERCIDÆ.							
Microperca punctulata, Putn.	15	16	1	..	..	..	3
Boleichthys eos, Jor. & Copeland	20	1	1	..	10		
Nothonotus niger (Raf.), Jor.	..	..	..	..	..	..	3
Etheostoma flabellare (Raf.), Jor.	..	..	..	..	..	..	3
Pœcilichthys variatus (Kirt.), Ag.	..	3	..	..	..	..	Common
Pœcilichthys spectabilis, Ag.	..	1	..	2	..	..	75
Boleosoma brevipinne, Cope	..	34	11	42	25	..	Common
Diplesium blennioides, Raf.	..	..	..	..	..	1	Common
Imostoma shumardii (Grd.), Jordan	..	..	..	..	..	6	50
Alvordius aspro, Cope & Jordan	..	..	..	..	..	..	

	I. Tributaries to Potomac	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. Wabash R.
PERCIDÆ.							
Alvordius gloriosus (Nelson), C. & J.	..	..	..	..	..	1	
Alvordius evides, J. & C.	..	3	..	..	..	..	1
Percina caprodes (Raf.), Grd.	..	..	..	..	..	1	Common
Percina manitou, Jordan	..	3	..	..	..		
Pleurolepis pellucidus (Baird), Ag.	..	..	..	..	..	..	20
Perca flavescens (Mit.), C. & V.	15	4	..	..	20		
Ponoxys annularis, Raf.	..	..	..	..	..	1	1
Ponoxys hexacanthus (C. & V.), Ag.	..	..	..	..	6	..	1
Micropterus floridanus (LeS.), Gill	11	6	7	6	19	22	Common
Micropterus salmoides (Lac.), Gill	..	1	..	..	..	2	Common
Chamobrytius guloses (C. & V.), Cope	1	..	..	..	7		
Amblophites rupestris (Raf.), Gill	..	1	..	..	1	4	Common
Aposomis cyanellus, Raf.	1	..	..	1	..	..	Common
Lepomis megalotis, Cope	..	..	..	..	..	..	25
Lepomis luciaor (C. & V.), Cope	25	18	27	..	95	25	Common
Xenotis inscriptus (Ag.), Jor.	..	..	..	..	..	..	25
Lepomis pallidus, Cope	..	..	..	4			
Xenotis megalotis (Raf.), Jor.	..	..	..	..	..	..	20
Xenotis nibilus (Kirt.), Jor.	..	..	..	..	..	..	Common
Pomotis aureus (Walb.), Gill	2	1	1	6	5		
APHREDODERIDÆ.							
Aphredoderus cookianus, Jordan	..	..	1				
SCIÆNIDÆ.							
Haploidonotus grunniens (Raf.), Gill	..	..	..	..	..	..	Scarce
COTTIDÆ.							
Potamocottus wilsoni (Grd.), Gill	..	..	..	..	..	..	1
ATHERINIDÆ.							
Labidesthes sicculus, Cope	19	..	5	..	53	171	Common
CYPRINODONTIDÆ.							
Zygonectes notatus (Raf.), J. & C.	..	8	9	..	..	61	Common
Zygonectes dispar, Ag.	..	7	..	..	16		
Fundulus diaphanus (LeS.), Ag.	13	25					
UMBRIDÆ.							
Umbra limi (Kirt.), Gthr.	3	14	15	..	1	..	10
ESOCIDÆ.							
Esox lucius, L.	..	2					
Esox salmoneus, Raf.	11	1	2	..	1	..	Common

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
SALMONIDÆ.							
Argyrosomus clupeiformis sisco, Jor.	..	..	..	..	15		
CLUPEIDÆ.							
Dorosoma cepedianum (LeS.), Gill	..	..	..	..	..	1	
CYPRINIDÆ.							
Campostoma anomalum (Raf.), Ag.	..	..	5	..	1	..	Common
Hyborhynchus notatus (Raf.), Ag.	2	41	..	30	3	24	Common
Hybognathus argyri is, Grd.	..	..	..	..	..	7	3
Ericymba buccata Cope	..	..	..	..	..	..	Common
Semotilus corporalis (Mit.), Put.	..	4	1	2	2	..	Common
Nocomis biguttatus (Kirt.), C. & J.	3	3	..	1	3	..	Common
Nocomis amblops (Raf.), C. & J.	..	..	..	..	..	..	Common
Nocomis dissimilis Kirt., C. & J.	..	..	..	..	..	..	25
Rhinichthys obtusus, Ag.	..	..	..	7			
Rhinichthys atronasus (Mit.), Ag.	..	..	..	..	..	..	Common
Hybopsis stramineus, Cope	..	..	..	7	..	..	100
Hybopsis plumbeolus, Cope	..	..	..	..	3		
Hybopsis storerianus (Kirt.), Ag.	2						
Hemitremia heterodon, Cope (?)	..	..	..	..	5		
Luxi us cornutus (Mi), Jor.	4	34	..	4	16	..	Common
Episema scabriceps, Cope	..	..	..	..	..	..	25
Minnilus spilopterus, Cope	..	..	3	..	10	..	75
Minnilus analostanus (Grd.), C. & J.	..	..	..	..	..	48	Common
Minnilus ariommus, Cope	..	..	..	..	..	..	50
Minnilus dinemus, Raf.	..	..	..	..	..	..	25
Minnilus rubellus (Ag.), Jor.	..	..	..	..	..	2	Common
Minnilus rubrifrons (Cope), Jor.	..	..	..	..	7	..	Common
Notemigonus americanus (Lac.), Jor.	12	..	16	5	24	10	Common
CATOSTOMIDÆ.							
Catostomus teres (Mit.), LeS.	..	6	..	9	..	1	Common
Catostomus nigricans, LeS.	..	..	..	..	..	..	Common
Erimyzon oblongus (Mit.), C. & J.	1	1	27	1	4	..	Common
Erimyzon melanops (Raf.), C. & J.	..	..	..	..	..	3	Common
Moxostoma anisurum, Raf.	..	..	..	..	..	6	
Moxostoma duquesnii (LeS.), Jor.	..	..	..	..	..	5	Common
Placopharynx carinatus, Cope	..	..	..	..	..	1	
Carpiodes difformis, Cope	..	..	..	..	..	1	
Carpiodes carpio, Raf.	..	..	..	..	..	1	5
Ichthyobus bubalus, Raf.	..	..	..	..	..	1	
SILURIDÆ.							
Ictalurus punctatus (Raf.), Jor.	..	..	..	..	..	1	5
Amiurus cupreus, Raf.	1	1	..	..	1	4	5

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Manmee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
SILURIDÆ.							
Amiurus nebulosus (LeS.), Gill	..	..	..	..	1	..	Common
Amiurus atrarius (Dek.), Gill	1	5	19				
Hopladelus olivaris (Raf.), Gill	..	..	..	..	..	1	
Noturus flavus, Raf.	13	2	..	..	..	..	35
Noturus miurus, Jor. Mss.	..	..	1	..	..	8	60
AMIIDÆ.							
Amia calva, L.	..	..	1				
LEPIDOSTEIDÆ.							
Lepidosteus "huronensis, Rich."	..	..	..	..	..	..	5
POLYODONTIDÆ.							
Polyodon folium, Lac.	..	..	..	..	..	..	5
PETROMYZONTIDÆ.							
Petromyzon niger, Raf.	..	..	..	..	..	..	25
Petromyzon argenteus, Kirt.	..	..	..	..	..	..	1

Notes and Descriptions.

I give here notes on some of the foregoing species, with descriptions of those less known, as well as of a few new species which have come to my notice from Indiana, Wisconsin, and Illinois.

1. **Boleichthys eos, Jordan and Copeland, n. s.**

Boleichthys exilis, Jordan Man. Vert., 1876 (in part—probably not of Girard Proc. Acad. Nat. Sci., Phila., 1859).

Boleichthys eos, Jordan Mss. Nelson Bull. Ills. Museum Nat. Hist. Soc., 1876, 34 (partial diagnosis, Wis. and N. Ills.)

? *Boleichthys exilis*, Nelson Bull. Ills. Mus. Nat. Hist., 34 (the small species or variety noted below).

Body elongated, slender, somewhat compressed, especially behind, rather heavy forwards, with long caudal peduncle. Head rather long, rounded in front, $3\frac{7}{8}$ in length, without caudal. Greatest depth of body $5\frac{1}{4}$ in length. Mouth small, little oblique, the upper jaw a very little longest. Eye large, $3\frac{1}{3}$ in head, rather high up, longer than snout.

Dorsal fins high, about equal, the second highest, rather shortest, the two well separated. Anal moderate, smaller than second dorsal, caudal truncate. Pectorals rather short, reaching about as far as tip of ventrals, not $\frac{2}{3}$ the distance to vent. Cheeks, opercles, neck, and ventral region with small scales. Thoracic region naked. Vent a trifle nearer snout than tip of caudal. Lateral line to end of first dorsal on 22 to 26 scales, the total number being 57 to 59.

Color (in alcohol) dark olive, with darker markings, *i.e.*, 10 or 12 blackish dorsal spots or bars, and as many short bars across the lateral line nearly opposite the dorsal bars but not continuous with them. Various sharply defined but irregular black markings on lower parts of sides and on cheeks, etc. Second dorsal, caudal, and pectorals strongly marked with wavy black bands as in *Catonotus*. In females the first dorsal is similarly specked. In males dark terminal and basal bars are present (blue in life). Top of head dark. A black streak forward from eye, and another downward.

The life colors are very brilliant. The interspaces between the lateral bars as well as most of the ventral region are of a brilliant vermilion. The first dorsal is bright blue, with a broad median band of crimson.

Fin rays D. ix—11 (rarely x—10 or x—11) A ii—7.

Length $2\frac{1}{2}$ to 3 inches. *Habitat:* Rock River, Wisconsin, Wisconsin River, Fox River, Illinois, and streams of North Indiana.

In Fox River (Wis.) Suamico River, and other tributaries of Lake Michigan, there occurs in abundance another *Boleichthys;* but whether specifically distinct from *B. eos* or not I am unable to say. My numerous specimens are all smaller, shorter, with large scales. Their coloration is different—plain brown with several large round red spots. This form is the *B. exilis* of Nelson's paper, and partly that of the Man. Vert., but it is very doubtful whether it is Girard's species which was described from the Upper Missouri.

The genus *Boleichthys* is very close to *Pœcilichthys*. I know of no character on which to separate the eastern species as *Hololepis*. The short-arched lateral line and distinct, sub-equal dorsal fins as well as the general form seem to be common to all.

2. **Nothonotus niger** (Raf.), Jor.

This beautiful and rare species has been noticed by few authors, and has been properly described by still fewer. The following seems to be its synonymy:—

Etheostoma nigra, Raf. Ich. Oh. 1820, 37 (Kentucky; a superficial description).
Nothonotus niger, Jordan Bull. Buff. Nat. Hist. Soc., 1876, 93, 134 (name only). Man. Vert., 1876, 219 (male specimen).
Pœcilichthys niger, Jordan and Copeland Bull. Buff. Nat. Hist. Soc., 1876, 162 (name only). Nelson Bull. Ills. Nat. Hist. Mus. 34 (Wabash Valley).
Etheostoma maculata, Kirtland Bost. Journ. Nat. Hist., III., 276, 1841 (description incomplete and partly erroneous). Storer Synopsis, 271, 1846.
Nothonotus maculatus, Agassiz Bull. M. C. Z., 1863, 3 (name only).
Boleosoma maculatum, LeVaillant, Archives du Museum, 1873.
Catonotus maculatus, Jordan Ind. Geol. Surv., 1874, 214 (name only).
Pœcilichthys camurus, Cope, Proc. Am. Phil. Soc. 1870, 265 (Cumberland River, Tenn. Excellent description).

3. **Pœcilichthys variatus** (Kirt.), Ag.
Pœcilichthys cæruleus (Storer), Ag., and of most authors.

I have restored Dr. Kirtland's name for this species for the reasons given below. His description of *Etheostoma variata* has been variously misunderstood, as may be seen in its reference to genus *Hadropterus* by Putnam and *Boleosoma* by Le Vaillant. The latter author establishes a new genus, *Astatichthys*, for *P. cæruleus* and its relatives, because, as assumed, the original type of *Pœcilichthys*, Ag. (*E. variata*) is a *Boleosoma*. Dr. Kirtland ascribes twelve dorsal spines to his *variata* and ten to his *maculata*. The reverse is the truth, and the two figures were perhaps accidentally interchanged, otherwise his descriptions in both cases are characteristic and fairly correct.

Recently specimens from Wisconsin, fully identified as *P. cæruleus* (Storer) by Profs. Putnam, Cope, Copeland, and the writer, were sent by Dr. Hoy to Dr. Kirtland, who unhesitatingly pronounced them to be his own *Etheostoma variata*. The following in regard to this point is from a private letter from Dr. Kirtland to Dr. Hoy in November, 1876.

"The *Etheostoma variata* I first indicated as an undescribed species of fish in the 2d Geological Report of Ohio, Nov. 1, 1838. In 1841 I published a description of it in Vol. III. of the Boston

Journal of Natural History, p. 274. In 1838 I indicated it as a native of the upper waters of the Ohio, and of the Lake Erie waters.

"Dr. Storer first described the *Etheostoma cærulea* in the Proceedings of the Boston Society of Natural History in 1845. At the time Dr. Storer's description appeared I had no doubt that his fish was the same as my *variata*, nor have I seen any reason since to change that conclusion. His specimen was probably received preserved in spirits; mine was described as it was fresh and alive—conditions affecting extensively their appearance. Sex, season of the year, spawning, locality, etc., vary greatly the character of fishes, and none more than this *Etheostoma*.

"My figure and description were made out from an old and large male taken from the spawning bed in the Mahoning River, in Youngstown, just as it had discharged its milt. It was lank, dull, and easily captured in its weak and emaciated condition, as all male fish are prone to be at this juncture. The brilliancy of its coloration had not yet become impaired. In a collection of many specimens you may find almost each one to differ from the others—some so essentially in their characters as to furnish new species to our 'new species mongers.'

"To that class of meddling naturalists I belonged at the time I described the *Etheostoma erythrogaster* and figured it in Hamilton Smith's 'Annals of Science.' It was a variety no doubt of the *variata*, a female teeming with eggs."

4. **Imostoma shumardii.** (Grd.) Jordan.

Hadropterus shumardi, Grd. Proc. Acad. Nat. Sci. Phila., 1859, 100, Arkansas. *Etheostoma shumardii*, Jord. & Copel. Bull. Buff. Soc. Nat. Sci. 1876.

Several specimens from the Wabash River at Hutsonville, are probably referable to this species. They appear to represent a new generic type, for which the name *Imostoma* is proposed (*eimi* to move, go—*stoma* mouth, in allusion to the projectile jaw, which distinguishes this genus from *Alvordius*). *Imostoma* may be thus characterized: Lateral line complete; body scaly; no ventral plates (?); upper-jaw projectile; vomerine teeth; anal as large as second dorsal. Type, specimens from Wabash River supposed to be *Hadropterus shumardii*, Grd.

Specific characters.—Body stout and heavy forward, compressed behind. Depth about 5 in length. Head blunt, broad,

and thick, resembling that of *Diplesium* (*Hyostoma*, Ag.), its length 3⅘ in length of body to caudal, its depth at pupil half its length. Eye large, rather shorter than snout, 3½ in head. Interorbital width ⅔ of eye.

Mouth large and broad, the lower jaw wide, a little shorter than upper; maxillary reaching to eye. Cheeks, opercles, and neck scaly; chest naked. Abdominal region naked anteriorly, scaly in front of vent; no traces of mucronate plates in any of my specimens. Scales of body rather large; lateral line with 56 scales, about 6 above and 11 below.

Fin rays, D. x—15, A. ii. 11.

Dorsal fins large, first larger than second, which is smaller than anal, the two dorsal fins well separated. Anal fin large, prolonged behind, farther than the dorsal; in one specimen greatly elevated, reaching to the caudal. This is perhaps a sexual feature. Anal spines large, the first largest. Pectorals reaching to tips of ventrals ⅔ to vent.

Color dark, densely but vaguely blotched with darker but not black. Sides with 10 or 12 obscure blotches, the anterior ones bars. A large black spot on base of spinous dorsal behind, and a small one in front. Second dorsal, caudal and pectoral barred as in *Alvordius aspro*. A very strong black suborbital bar, and a faint dark line across muzzle. Length 3 inches.

Habitat. Wabash River (Jordan), Arkansas River (Girard).

5. Alvordius phoxocephalus (Nelson), Cope and Jordan.

Etheostoma phoxocephalum, Nelson, Bull. Ills. Mus. Nat. Hist. I. 1876, 35 (Illinois River), Jordan and Copeland, Bull. Buff. Soc. Nat. Sci. 1876.

An additional specimen of this species, in better preservation than any of Nelson's types, enables me to give a fuller description, and to correct one or two slight errors in the original account.

Body rather slender, compressed, depth 5⅓ in length. Head 4 in length, extremely long, narrow, and tapering; the snout very acuminate. Mouth large, somewhat oblique, the maxillary reaching to eye, the lower jaw unusually narrow and long, scarcely shorter than upper. Depth of head at pupil one-third its length. Eye 4¼ in head, about equal to snout; half wider than interorbital space. Teeth small, on jaws and vomer. Upper-jaw not protractile.

Cheeks, opercles, and neck with small scales; those on the

cheeks imbedded but numerous; chest naked. Ventral line with enlarged plates. Scales small, 68 in lateral line, about 12 above and 14 below. Fin rays, dorsal xii—13 (xiii—12, Nelson) A. ii. 9. Dorsal fins well apart, the second about equal to anal; the spinous dorsal long; caudal lunate. Pectorals reaching to tips of ventrals, ⅘ to vent.

Color brownish above, mottled with darker. Lateral line with about 12 blackish spots, which are more or less quadrate, and scarcely twice the size of the eye. Both dorsals, and caudal with narrow dark bars of spots. A black streak on muzzle, but the suborbital bar very obscure. A small black spot at each end of the lateral line.

The peculiar form of the head and mouth separate this at once from all the previously known species except *A. macrocephalus*, Cope. The latter has naked cheeks and opercles, and differs in several other respects.

Habitat. Illinois River (Nelson), Wabash River (Jordan).

6. **Alvordius aspro**, Cope and Jordan, nom. sp. nov.

Etheostoma blennioides, Kirtland, Bost. Journ. Nat. Hist. (figure, but not description, which is copied from Rafinesque).

E. blennioides, Agassiz, and later writers.

Etheostoma blennioides, Raf., is the fish usually known as *Hyostoma cymatogrammum*, and for that fish his name must be retained. *E. blennioides*, Auct., being thus left without a specific name, that of *aspro* is here proposed.

The genus *Etheostoma*, Raf., was originally based on *E. flabellaris*, *E. caprodes*, and *E. blennioides*. The last two afterwards formed the subgenus *Diplesion*, leaving *Etheostoma* for *E. flabellare*.

7. **Alvordius evides**, Jordan & Copeland, sp. nov.

Etheostoma nigrofasciatum, Manual Vert. 1876, p. 223 (not *Hadropterus nigrofasciatus*, Ag.).

Etheostoma evides, Jordan & Copeland, Mss. in Nelson, Bulletin Ills. Hist. Soc. Dec. 1876, p. 36.

Body elongate, rather short for the genus, little compressed, depth 5⅓ in length, without caudal. Head heavy, 4¼ in length to caudal; its greatest depth equal to its breadth, 1¾ in its length. Profile convex, outlines prominent just behind eyes, depressed at occiput. Eye large, rather high, their length rather more than snout, and than interorbital space 3½ in head. Upper jaw a little

the longer. Mouth not so large as in *A. aspro*, a little oblique, the maxillary reaching to opposite front of orbit. Vomerine teeth. Upper jaw not protractile, the skin of the middle of the lip continuous with that of the forehead. Cheeks, neck above, and throat naked; opercles with a few rather large scales. Ventral strip naked in one specimen, with a few enlarged scales in the other. Vent midway between eye and tip of caudal.

Fin rays; dorsal x—10 (xi—10), anal ii. 8 (ii. 9).

Pectoral fins as long as head, their tips about even with those of the ventrals. Ventrals long, their tips reaching $\frac{2}{3}$ the distance to vent. Anal rather short and unusually high, the longest rays extending farther back than the longest dorsal rays when the fin is depressed, the height of the longest ray $\frac{2}{3}$ the length of the head. Anal spines well developed, their height $2\frac{1}{2}$ in head.

Spinous dorsal long, moderately high, lower than the soft dorsal, its base equal to the distance from its first ray to the front of the eye. Dorsal fins well apart, separated by a distance greater than the diameter of the eye. Second dorsal lower than anal, but with a longer base, the two fins about equal in absolute size. Caudal fin moderate, emarginate, as long as from tip of muzzle to anterior margin of opercle.

Color dark-grayish or olivaceous above, tessellated with black. Top of head dark. A black band across top of head, just behind the interorbital space; a distinct vertical suborbital bar; a broad horizontal stripe across upper part of cheeks on the level of the pupil, becoming a narrow stripe across the opercle.

Body with about seven broad transverse black bars, extending from below lateral line on one side across the back and down the other side. These are rather faint above, their color blending with the dark of the back, and they are broadest and most distinct along the lateral line, just below which they end rather abruptly. These bars are wider than the eye, and most of them extend a distance below the lateral line equal to the diameter of the eye. These bars are connected along the lateral line by a faint black stripe. The fourth band is rather the most distinct, and it passes over the back in the interspace between the two dorsal fins. The two posterior bars are rounded and spot-like, but they also meet across the back. Dorsal with one or two longitudinal blackish streaks, and some vague markings on caudal. Fins otherwise uncolored.

Belly and lower parts clear, creamy, becoming pale orange behind ventrals. Interspaces between bands whitish with dark spots. In the smaller specimen which has been longer in alcohol, the black has faded to a dark chestnut.

Habitat. White River near Indianapolis in rapid water on stony bottom. The three specimens known were taken by Prof. Copeland and the writer at the same point at different times. The largest specimen measures $2\frac{1}{2}$ inches, the others $2\frac{1}{4}$.

This species is one of the most beautiful of all the darters. Its colors, though not gaudy, are very striking, and quite unlike those of any other species known to me, resembling most those of *Alvordius aspro.*

In the Manual of the Vertebrates of the N. E. U. S., I identified the only specimen then in my possession with *Hadropterus nigrofasciatus*, Ag., but that species turns out to be something quite different. The small number of dorsal spines as well as the peculiar coloration separates *A. evides* at once from its congeners *aspro*, *maculatus*, *macrocephalus*, *phoxocephalus*, and *nevisensis*. *A. fasciatus* is the only species which resembles it in this respect, but it is otherwise entirely different.

Percina manitou, Jordan, sp. nov.

Body elongate, cylindrical, less compressed than in *P. caprodes*, the depth being about 7 in length. Head $4\frac{1}{4}$ in length (without caudal), slender, but noticeably shorter and broader than in *P. caprodes*, the snout being considerably shorter, blunter, and less sloping. Eye large, about equal to snout, $3\frac{1}{2}$ to 4 in head, greater than interorbital space. Mouth small, less inferior, and less deeply cleft than in *P. caprodes*, the maxillary not extending to opposite eye, the upper lip—as in *P. caprodes*—not protractile. Cheeks and opercles with small scales, the former hardly visible.

Scales small, about 90 in the lateral line, which is well-developed and continuous. Ventral line with enlarged, mucronate plates (in one specimen—in the others naked); chest naked; region anterior to dorsal fin above *entirely scaleless* and smooth—in *P. caprodes* this region is densely scaled, like the sides.

Fin rays, D. XV., 14. A. II., 10.

Fins moderate, ventrals reaching about half way to vent, rather further than pectorals.

Colors black and yellowish olive, as in *P. caprodes*, but the pattern different. The back irregularly and strongly marbled as

in *Alvordius aspro*, the lateral bars being short, and not extending up the sides much above the lateral line, the bars on one side not meeting their fellows on the opposite side. The bars themselves are subequal, not so sharply defined as in *P. caprodes*, short, about 20 in number, the last few blotch like, the last one a round jet black spot.

In *P. caprodes* the bars are alternately long and short, and each one meets its fellow of the other side across the back, a particularly distinct one crossing the back between the dorsal fins.

Dorsal fins and caudal mottled in both species.

Habitat. Lake Manitou in N. Ind., one of the sources of Tippecanoe R., 3 specimens in the Ind. State collection, each $3\frac{1}{4}$ to $3\frac{1}{2}$ inches long.

This species is, of course, closely allied to *P. caprodes*, but the different coloration and physiognomy, as well as the smooth neck, well distinguish it.

P. carbonaria, B. and G., from Texas, is apparently not identical with *P. caprodes*. I have numerous specimens of the latter from Alabama R.

Comparison of the Etheostomoid Genera.

The genera, which seem to be worthy of retention, in the peculiar group, family, or subfamily of *Etheostomidæ* (or *inæ*), may be thus compared :—

* No lateral line ; dorsal fins small, not very unequal, the two well separated, both larger than anal ; jaws about even ; scales large ; no ventral plates ; upper jaw not protractile ; size small ; colors dull ; fins barred. MICROPERCA, 1.

** Lateral line present on anterior half of body or less ; upper jaw not protractile ; caudal rounded ; no ventral plates ; second dorsal larger than anal ; fins barred.

† Dorsal fins well separated, about equal ; jaws nearly equal ; lateral line curved high over pectorals ; cheeks and opercles scaly ; body elongated and compressed ; colors often bright. BOLEICHTHYS, 2.

†† Dorsal fins distinct, about equal, the first short, but nearly as high as second ; cheeks and opercles scaly ; lower jaw longest ; body elongated ; a dark lateral band. ALVARIUS, 3.

††† Dorsal fins unequal, the first scarcely half the height of the second and rather short ; cheeks and opercles naked ; lower jaw longest ; body elongated, compressed ; branchiostegal membranes broadly united ; coloration in bars or lines of dots. ETHEOSTOMA, 4.

*** Lateral developed for at least two-thirds the length of the body.

a. Body moderately elongated; scaly, excepting sometimes definitely naked areas on neck, chest, and ventral line.

b. Second dorsal considerably larger than anal; no ventral plates; the middle region of the belly scaled.

c. Upper jaw not protractile; dorsal fins contiguous, the membrane of the first just reaching the base of second; mouth medium, the upper jaw a trifle the longer; cheeks naked (scaly in *N. zonalis*); body short, and usually deep; fins large, not barred, but in the female speckled; colors brilliant.

Lateral line incomplete. PŒCILICHTHYS, 5.

Lateral line complete. NOTHONOTUS, 6.

cc. Upper jaw protractile; mouth small, horizontal, and more or less inferior; lateral line complete; fins barred.

d. Vomerine teeth; anal spines often obscure or obsolete; dorsals contiguous, but separate; spinous dorsal rather short; body elongated; colors plain. BOLEOSOMA, 7.

dd. No vomerine teeth (at least in typical species); anal spines strong; cheeks and opercles scaly; body elongated, little compressed; head short and thick, with swollen cheeks; mouth very small; color bright. DIPLESIUM, 8.

bb. Second dorsal not larger than spinous dorsal, and little, if any, larger than anal, the two dorsal fins well separated; body little compressed; vomerine teeth; lateral line complete; two anal spines (except in *Alvordius peltatus*—a species of uncertain affinities); color, yellowish, with black bars and blotches.

e. Mouth wide, terminal, the upper jaw but little longest.

f. Upper jaw protractile; cheeks and opercles scaly; no ventral plates (?), body stout; head short and heavy. IMOSTOMA, 9.

ff. Upper jaw not protractile.

g. No ventral plates; the middle line of the belly with small scales; cheeks and opercles scaled. HADROPTERUS, 10.

gg. Ventral plates present (or falling, leaving a naked strip). ALVORDIUS, 11.

ee. Mouth narrow, inferior, overlapped by a tapering, more or less truncate, pig like snout; cheeks and opercles scaly; ventral plates present; or, if fallen, a naked strip; body elongated; size largest. PERCINA, 12.

aa. Body excessively long and slender, cylindric, with very thin, transparent scales, which are wanting over the ventral region, and scarcely visible on the dorsal; lateral line complete; cheeks and opercles scaly; mouth large; the upper jaw sub-protractile, and a little the longer; vomerine teeth; dorsal fins small, wide apart; head elongated; color transparent, with dorsal and lateral series of small dark spots. PLEUROLEPIS, 13.

Of the genera admitted above, *Alvarius* is imperfectly known. *Nothonotus* may be only a subgenus of *Pœcilichthys*, and *Alvordius* of *Hadropterus*. The claim of some of the others to independent rank seems not to be beyond question.

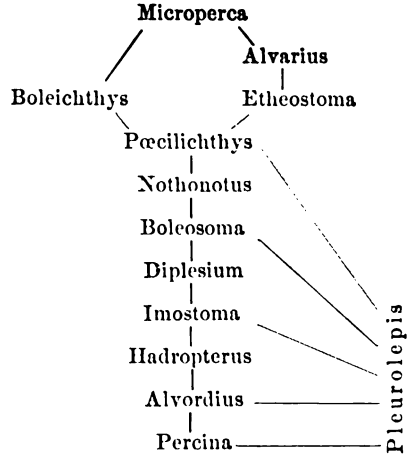
The other generic names used in this group seem to be synonyms, as follows:—

Hololepis, of Boleichthys.
Pegedictis, Catonotus, of Etheostoma.
Oligocephalus, Astatichthys, of Pœcilichthys.
Arlina, Estrella, Cottogaster, of Boleosoma.
Hypohomus, Plesioperca, of Hadropterus.
Pileoma, Asproperca, of Percina.

Aplesion, Grd., I do not know. *Pegedictis*, Raf., is, perhaps, based in part on *Catonotus*, and in part, perhaps, on the young of some Cottoid.

It is undoubtedly best to discard the name *Pegedictis*, which I unadvisedly revived in place of *Potamocottus*, Gill.

The relations of these genera may be rudely shown by the following diagram:—



7. **Copelandia eriarcha**, Jordan, sp. nov.

In a collection of Wisconsin fishes sent by Dr. Hoy to Prof. Copeland and myself for identification, I find a species of saw-fish which appears to be the type of a distinct genus. For this genus I have proposed the name of *Copelandia*, dedicating it to the memory of one of the most enthusiastic of naturalists, and most

genial of men, whose untimely death has been a great loss to our science.

The genus *Copelandia* is allied to *Enneacanthus*, *Hemioplites*, and *Centrarchus*. Its characters are as follows:—

Dorsal with 10 spines, anal with 4; the anal spines strong, the soft rays high; caudal fin rounded; opercle emarginate, with a black dermal border (as in *Enneacanthus*). A supernumerary maxillary bone. Palatine teeth. Appendages of anterior gill arch long, and in small number, much as in *Ambloplites*.

The typical species *C. eriarcha* is thus characterized: Body rather elongated, more so than in *Enneacanthus*, the profile forming a nearly uniform curve. Depth $2\frac{1}{4}$ in length; head $2\frac{3}{4}$; caudal peduncle rather abruptly narrowed. Form most like that of *Apomotis cyanellus*, Raf. (*mineopas*, Cope). Eye very large, 3 in head; longer than snout; much more than interorbital space; mucous channels not large: scales on cheek large, in about three rows; mouth moderately large; the maxillary short and broad, with a distinct supplemental bone. Distance from snout to dorsal equal to length of the base of that fin; spines rather high, the longest equal to distance from snout, just past pupil; the first spine short, the last regularly longer. Soft dorsal high, its height equal to distance from snout to front of opercle. Caudal fin slightly rounded, its length $\frac{4}{5}$ that of head. Anal fin very large, beginning well forward, midway between base of caudal and nostrils. Spines 4, all strong, the last very large and strong, as long as from snout to posterior part of pupil. Soft rays a little higher than those of dorsal, and reaching base of caudal. Ventral fins large, with a strong spine which reaches to beginning of anal, the longest soft ray reaching first soft ray of anal. Pectorals moderate, about as long as the base of anal, reaching to tips of ventrals. Scales large, 3—33—10; lateral lines running high, parallel with the back, ending about opposite last rays of dorsal.

Fin rays D. X., 9; A. IV., 8; V. I., 5.

Color faded in spirits. Vertical fins with numerous round whitish spots, which were probably blue in life; a black, opercular spot. Length, 3 inches.

Habitat.—Menomonee R., at Wauwatosa, Milwaukee Co., Wis. Coll., Dr. P. R. Hoy.

8. **Lepomis peltastes**, Cope.

The sunfish referred to by Nelson (*op. cit.* 38) as *Ichthelis anagallinus*, from Fox R., Ills., is not Cope's *anagallinus*, but another species, probably *Lepomis peltastes*, Cope, a species which, following Prof. Bliss (*in lit.*), I have hitherto considered identical with *anagallinus*. Both *oculatus*, Cope, and *peltastes*, Cope, I now consider distinct species. I have specimens of *anagallinus* from Salt R., Ky., of *oculatus* from Racine, Wis., and of *peltastes* from the Upper Illinois.

Prof. Cope and the writer have reviewed the nomenclature of our Centrarchine genera, and have jointly come to the conclusion that the genera mentioned in the synopsis below are the ones worthy of adoption.

We have deemed that science would be best served by applying to these names the strict rules of zoological nomenclature. The grounds on which proposed changes are based are given in a supplement to this paper. The characters of the genera adopted are brought out in the following synopsis. Most of them were first pointed out by Prof. Cope, but for their arrangement here the present writer only is responsible.

Comparison of the Centrarchine Genera.

The genera of sunfishes (*Centrarchidæ*) may be thus compared:—

* Dorsal fin much more developed than anal fin (the base of the former 1½ to 3 times that of the latter), the soft parts of the two fins about equal, and terminating at the same vertical behind; long gill rakers if present, in small number, about 10.

† Anal spines 3 or 4.

a. Caudal fin emarginate; anal spines 3; dorsal spines (normally) 10.

b. Opercle ending behind in an entire convex process or flap, which always has a black spot; dorsal fin not notched.

c Maxillary without supplemental bone; mouth rather small, with equal jaws; maxillary usually not reaching to orbit; scales ctenoid.

d. Lower pharyngeal bones broad, with blunt, rounded, "paved" teeth. Appendages on anterior branchial arch ("gill rakers"), short, blunt, and weak; no palatine teeth.

POMOTIS, 1.

dd. Lower pharyngeal bones narrower, with fewer teeth which are conic and sharp.

e. Gill appendages short, blunt, and weak, not differentiated—as in *Pomotis* (species with the opercular flap much elongated—the spines low, the colors brilliant, cheeks ordinarily with blue stripes, and no palatine teeth).

XENOTIS, 2.

ee. Gill rakers long and slender, the lowermost 8 or 10 larger than the rest (species with the dorsal spines more or less elevated, the opercular flap comparatively broad and short, the colors less brilliant—though often lustrous, and often no blue lines on cheeks—palatine teeth often present.

LEPOMIS, 3.

cc. Maxillary with a supplemental bone; gill appendages long (as in all the following genera); lower pharyngeal teeth conic (as in all the following); mouth rather large, the lower jaw protruding; scales weakly or not ctenoid; palatine teeth (as in all the following).

f. Tongue without teeth; supplemental bone narrow; maxillary reaching to between front and middle of orbit; general aspect of *Lepomis*. APOMOTIS, 4.

ff. Tongue with a conspicuous patch of teeth; supplemental bone large; mouth wide, reaching to opposite posterior margin of eye; form, aspect, and dentition of *Amblopliles*, etc. CHÆNOBRYTTUS, 5.

bb. Opercle emarginate behind—ending in two flat points with a dermal border (as in all the genera following); dorsal fin deeply notched, separated almost into two fins, the last spines being shortened; body elongate; mouth very wide—the lower jaw longest, the supplemental maxillary large; gill appendages long; size large. MICROPTERUS, 6.

aa. Caudal fin rounded; mouth small, with equal jaws; gill appendages long, in small number; opercle emarginate; species of small size.

g. Dorsal fin angulated, the middle spines longer than some of the posterior ones; supplemental maxillary wanting (or rudimentary?); anal spines 3; dorsal 10; body barred. MESOGONISTIUS, 7.

gg. Dorsal fin continuous; supernumerary bone well developed.

h. Dorsal spines normally 9; anal spines 3.

ENNEACANTHUS, 8.

hh. Dorsal spines 10; anal 4. COPELANDIA, 9.

hhh. Dorsal spines 8; anal 4. HEMIOPLITES, 10.

†† Anal spines 5 to 7; dorsal spines 10 to 13; teeth on tongue and palate; mouth large; a strong supplementary maxillary bone; lower jaw longest; opercle emarginate; gill appendages long and strong—8 or 10 of the large ones.

i. Caudal fin rounded; scales cycloid; anal spines normally five. ACANTHARCHUS, 11.

ii. Caudal fin emarginate; scales ctenoid; anal spines normally six. AMBLOPLITES, 12.

** Dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; lower jaw longest; supplemental maxillary bone present; opercle emarginate; gill rakers very long, in large number (20 to 30); fins large; scales faintly or not ctenoid.

k. Spinous dorsal shorter than soft part, continuous with it—the species 5 to 8 in number, rapidly graduated; anal spines normally 6; body compressed and rather elongate; mouth large. POMOXYS, 13.

kk. Spinous dorsal longer than soft part, forming an angle with it, the spines about 12 in number, not rapidly graduated; anal spines normally 8; body deep; mouth moderate. CENTRARCHUS, 14.

9. **Aphrodedirus cookianus**, Jordan, sp. nov.

In the collection from St. Joseph's River of the Maumee, I find a single specimen of a Pirate Perch, which differs about equally from the Eastern *A. sayanus*, and the *Sternotremia isolepis*, recently described by Mr. Nelson from Illinois. Its characters are so peculiar that I see no alternative but to consider it as a new species, and to refer it to the genus *Aphrodedirus*.

Body broad, stout, elevated at the dorsal, the depth $3\frac{1}{3}$ in length, without caudal. Head large, broad and stout, 3 in length, its greatest thickness a little more than half its length, its depth at the pupil a little less. Mouth wide, lower jaw longest; maxillary reaching anterior margin of eye. Eye moderate, $4\frac{1}{2}$ in snout, its posterior margin nearly midway of head, $1\frac{1}{2}$ in snout, and in interorbital space. Lower posterior angle of cheek about a right angle.

Fin rays D. III., 11. A. II., 6. V. 7. B. 6.

Beginning of dorsal much nearer snout than base of caudal, base of dorsal $1\frac{1}{6}$ in distance from snout to first ray; pectoral as long as from snout to opercular margin; tips of pectorals not reaching as far as those of ventrals.

Ventrals considerably more than half length of head, reaching $\frac{4}{5}$ the distance to anal. Long anal spine $2\frac{1}{3}$ in head; caudal rounded.

Vent midway between junction of branchial membranes and

ventral fins, about $\frac{2}{3}$ the diameter of the eye behind the little knob which is on the throat in all the species of this family, the length of the snout in advance of the ventrals, about under the middle of the opercles.

Scales very small, strongly ctenoid, not easily seen along middle of body, largest on cheeks and on opercles. Lateral line distinct for a short distance only, about 58 scales in its entire course.

Color dark olive, appearing bronze in spirits, profusely speckled with dark points, which give the fins a dark color; a dark bar at base of caudal and a light one behind it. Length 3 inches.

Habitat. Sawyer's Creek, outlet of Long Lake, Kendallville, N. E. Indiana (Waters of Lake Erie). This species is named in honor of the naturalist who first collected it.

This fish differs from *Sternotremia isolepis* in the anterior position of the vent, which is nearly as in *Aphrodedirus sayanus*. It is stouter, has a larger head, smaller scales, and a shorter anal spine. The ventral fins are also decidedly larger and longer. Several minor differences are noticeable on comparison with one of Nelson's types. *Aphrodedirus sayanus* has a more elongated body, a longer head, much larger scales, a more backward position of the dorsal, and an increased number of spines in the dorsal and anal. At least such is the case in a specimen examined by me from near Philadelphia. The position of the vent in *Sternotremia* seems sufficient to characterize that genus, but the species of the two genera, as among our *Centrarchidæ* and *Cottidæ*, are "cast in the same mould." *Sternotremia* apparently represents a step in a transition from *Aphrodedirus* towards *Percidæ*.

In the original description of *S. isolepis* (Bull. Ills. Mus. Nat. Hist., I., 1876, 39), "Vent more than twice as far from lower jaw as from ventrals," should read from *tips* of ventrals."

10. **Cottopsis rieii**, Nelson.

Nelson, Bull. Ills. Nat. Hist. Soc., 1876.

A second specimen of this curious species, received from Dr. P. R. Hoy, of Racine, Wis., enables me to supplement the original description. The occurrence in the Great Lakes of this type formerly supposed to be peculiar to the Pacific Slope is very interesting.

Body moderately elongated, depressed; the head especially so. Depth $5\frac{1}{3}$ in length, the head $3\frac{3}{5}$. Body quite abruptly contracted

opposite the base of anal, the body behind head nearly as deep as wide.

Body behind the vent rather slender, subterete, giving a subpole-like form to the body.

Jaws about equal, the lower narrower, but projecting in front; mouth rather contracted, the maxillary extending to opposite anterior nostril. Eye of the head, but rather less than the interorbital space, about equal to snout. Eyes close together, entirely superior.

Head very broad and flat, as broad or broader than long, including the perpendicular spines, its depth half its length. Profile rising rapidly from head to base of dorsal, which runs along a decided ridge or carina.

Preopercular spine extremely large, more than three times as long as in any other of our fresh-water Centrachi, quite long as the eye. This spine is hooked backwards, and is slightly spinal, giving the fish a decidedly bullhead-like or sun-like physiognomy. Three spines hooked downwards, below the large one, the lower concealed. A strong spine directed forwards at base of opercle. Isthmus as wide as from snout to middle of orbit.

Fin rays, D. VIII—11. Anal 12. Ventralis I. 5. Pectoralis 13. Branchiostegals 6.

Base of pectorals crescentic, their tips just short of anal, the rays all simple. Ventrals under pectorals reaching ⅔ to vent: their membrane decurrent. Dorsal beginning a trifle beyond ventrals, rather nearer anal than snout. Vent midway between base of caudal and snout. Depth at first ray of anal less than half length of head, the thickness at the same point a little more than one-third. Least depth ⅛ of head. Caudal peduncle slenderer than in any other Cottoid known to me in our fresh waters. Head smooth. Space above lateral line, behind head covered with small stiff prickles, slightly hooked backwards, readily visible as little black specks when the skin is dry. Axillary region *not* provided with spines. (These are present in most species of *Potamocottus*.)

Color pale brown, rather finely speckled and mottled with darker brown, not at all as in *C. semidea*, much as in *Lota*, more as in *Lophopsetta*. Pectoralis mottled; belly white. Length of smaller specimen (Nelson's type) 2⅝ inches; of larger, 3⅛.

Habitat. Lake Michigan, in deep water. Two or three other

specimens have been seen, but never preserved (Dr. Hoy). The cow-like expression of the face is very characteristic.

11. **Uranidea hoyi**, Putnam, MS.

Uranidea hoyi, Putnam MS. (1875). Jordan, Man. Vert., 1876, 244 (name only). Jordan and Copeland, Bull. Buff. Soc. Nat. Sc., 1876 (name only). Nelson, Bull. Ills. Mus. Nat. Hist., 1876, 41 (diagnosis).

This species has been for some time named in MS., but no full description published. Putnam's types are now in my possession. They show the following characters. The portion relating to the vertical fins is taken from notes by Dr. Hoy, as those parts are now entirely obliterated on the specimens.

Body small, rather short and thick, the depth about $5\frac{1}{2}$ in length. Head $3\frac{1}{3}$ in length, to base of caudal. Eyes large, high up, and close together; about equal to snout, $3\frac{2}{3}$ in head, three times the interorbital space. Head rather narrow and contracted; the lower jaw narrowed and slightly projecting. No palatine teeth (?); maxillary reaching anterior border of eye, or a little beyond.

Preopercular spine prominent, sharp, very nearly straight, directed backwards, but not strongly upwards; its form and direction peculiar in this genus. Below this is another sharp, prominent spine, also nearly straight, directed partly downwards. One or two minute concealed spines still lower. Isthmus well developed.

Pectoral fins long, longer than the head, reaching beginning of anal. Ventral fins long, reaching almost to vent. Vent midway between snout and base of caudal (in ♂); in the female further back, owing to the distended abdomen. Ventral rays I. 3 (on one side of each specimen apparently I. 4; perhaps a soft ray has been split).

Fin rays "D. VI. 15; A. 11; V. I. 3; P. 13; C. 12; the first dorsal low and small, $\frac{3}{4}$ as long as soft part, and connected to it by membrane. Fins all low." (Dr. Hoy.)

Color nearly obliterated. Lower parts profusely punctate.

Length of specimens, $2\frac{1}{6}$ inches.

Habitat. Lake Michigan—in deep water.

Female specimen taken 12 miles off Racine, Wis., in 12 fathoms, June 4th, 1875, by Dr. Hoy; the male off Milwaukee, June 15th. The specimens are now in bad condition, from rough handling.

The female is distended with ripe eggs, so that the width of the body is one-third the total length.

This species seems to be quite distinct from all those described by Girard. The peculiar characters are the number and form of the preopercular spines, the contracted mouth, the large eyes, the small size of the body, and the length of the ventral fins. The characters first mentioned are the most striking, and they indicate some affinity with *Triglopsis*.

12. **Uranidea kumlienii, Hoy, MS.**

U. kumlienii, Hoy, Nelson, Bull. Ills. Mus. Nat. Hist., 1876, 41.

One of Dr. Hoy's types, in very bad condition, is in my possession. It has grown soft in weak alcohol, and its remarkable slenderness of body is, perhaps, in part at least, due to this fact.

Body slender and elongated, as in *U. boleoides;* its depth 6 (?) times in length. Head large and long, its width a little more than half its length, its depth a little less, $3\frac{1}{3}$ in length of body. Eye large, $3\frac{1}{2}$ in head, about equal to snout, more than twice the width of interorbital space.

Base of pectorals crescentic; the fin about as long as head; the lower rays rapidly shortened, reaching second or third dorsal ray, and falling just short of anal; fourth and fifth rays longest. . . . .

Vent equidistant between base of caudal and front of eye.

Mouth pretty wide and oblique, the maxillary reaching to middle of eye. Lower jaw projecting. No palatine teeth. Preopercular spine large, directed upwards and backwards, not strongly hooked.

Fin rays, D. VI. 17; A. 12; P. 14; V. I. 3.

First dorsal rather high; $\frac{2}{3}$ the height of the second; the second spine longest, and filamentous (as is apt to be the case in rotten Cottoids); the two fins connected by a membrane. Caudal peduncle slender. Caudal fin narrow, more than $\frac{3}{4}$ length of head. Second dorsal and anal high.

Lateral line disappearing under middle of second dorsal.

Color obliterated—traces of a black spot on spinous dorsal.

Length of specimen, 3 inches.

Lake Michigan, in deep water. (Dr. Hoy.)

This species is dedicated by Dr. Hoy to Mr. A. L. Kumlien.

Nelson's description (l. c.) was made up from my notes on this specimen.

Genus **EUCALIA**, Jordan, 1876.

(Man. Vert., 1876, 248; type, *Gasterosteus inconstans*, Kirt.)

Some three years since I separated this genus in MS., and I adopted it in the Manual of Vertebrates (above cited), but it has not yet been fully characterized. I give below a comparison of the typical species of *Eucalia* with that of *Apeltes*, the genus most nearly related.

Common characters: Sides not mailed; caudal keel undeveloped; spines not serrated; dorsal spines in small number (3 to 6), ♂ in spring, with colors intensified.

APELTES, Dekay, 1842. (Type, *Gasterosteus quadracus*, Mit.)	EUCALIA, Jordan, 1876. (Type, *Gasterosteus inconstans*, Kirt.)
Generic characters.	
1. Dorsal spines not in a right line, the first being on one side of the median line when erected, the next two on the other.	1. Dorsal spines in a right line.
2. Ventral plates two, one on each side of the ventral fins.	2. Ventral plates coalesced into a narrow plate on the median line between the ventral fins.
3. No distinct post-pectoral plate.	3. A distinct sub-quadrate post-pectoral plate.
Associated characters.	
4. Dorsal spines normally III–I.	4. Dorsal spines normally IV–I.
5. Dorsal spines high, diminishing in size backwards.	5. Dorsal spines lower, diminishing in height forwards.
6. Suborbital plate, silvery, very distinct, semicircular.	6. Suborbital plate, indistinct, lunate.
7. A developed bony ridge on each side of the dorsal spines.	7. Dorsal ridge rudimentary and on median line.
8. Caudal peduncle very long and slender—as long as head; its least depth 4 to 5 times in its length.	8. Caudal peduncle short and relatively stout—shorter than head; its least depth about ⅓ of its length.
9. Species in salt or brackish waters.	9. Species in inland brooks and lakes.

13. **Eucalia inconstans** (Kirt.), Jor.

Depth equal to length of head, four times in body to base of caudal. Curve of the back rising very slowly. Eyes rather large, longer than snout, 3¼ in head, much wider than interorbital space. Curve of back descending rather abruptly towards the tail along the base of the soft dorsal. Curve of belly moderately convex,

ascending to form a slight constriction on caudal peduncle. Caudal peduncle rather thick, slenderest in females. Vent much nearer tip of caudal than snout (in Ohio specimens this is not true). Body compressed, but much less so than in either *pygmæa* or *cayuga*. Fin rays, D. IV.–I., 10 varying to III.–I, 9, and V.–I., 10. A. I, 10, V. I, 1. P. 10 to 12. C. 14.

Dorsal spines low and distant, not half so high proportionally as in *cayuga;* soft dorsal low, the first ray about twice as long as the spines. Anal similar, rather smaller, about three times the height of the curved spine which precedes it. Ventrals short and weak, shorter than eye (Wisconsin specimens), or rather longer (Ohio specimens).

Colors in life (in May), males jet black, somewhat coppery about the mouth; females olivaceous and mottled, finely dotted with black; young like the females. Length 2 to 2½ inches.

Habitat. Little sluggish brooks, among weeds and grass, from Ohio to Minnesota (?Greenland, Cope). Usually in company with *Umbra limi*. The species is notable for its pugnacity and voracity, and for its nest-building habits.

I have specimens from Oconto, Outagamie, Calumet, Winnebago, Brown, Racine, Sauk, Dane, Walworth, Green, and Jefferson Counties, in Wisconsin and from Cuyahoga County, Ohio.

14. Eucalia inconstans subsp. cayuga, Jordan, Man., Vert., 1876, p. 249.

Depth much less than length of head, 4⅓ in length of body; head 3⅓. Back arched considerably. Eyes large, as long as snout, wider than interorbital space, 3¼ in head. Caudal peduncle relatively much longer and more slender than in *inconstans*, its length about equal to depth of body.

Vent much nearer snout than base of caudal, as near as middle of caudal. Head, ventral cuirass, etc., about as in *inconstans*, body more strongly compressed.

Fin rays D. IV.–I., 10; A. I., 10.

Ventral spine stout, long, equal to depth of head at eyes, or to length of head behind eyes. Last dorsal spine ⅔ height of first soft ray; fins all high. Anal spine ⅔ height of first ray.

Color olivaceous, reticulated and mottled with darker. Length 1⅛ to 2 inches.

Habitat. Cayuga Lake, N. Y.; many specimens dredged by Dr. B. G. Wilder.

The special characters of this variety seem to be its small size,

high fins, and long caudal peduncle. If these prove constant, it may be necessary to consider it a species.

Sauvage (Nouvelles Archives du Museum, 1873) has distinguished a genus, *Gasterosteа*, based on *G. pungitius*, Linnæus, which seems to be equivalent to *Pygosteus*, Brevoort.

15. **Zygonectes dispar, Agassiz.**

Zygonectes dispar, Agassiz, Am. Journ. Sc. Arts, 1854 (Illinois River).
Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 42 (Illinois River).

Body short and deep, much compressed. The depth $4\frac{1}{3}$ in length. Head short and very broad, the flat interorbital space being $\frac{3}{4}$ of its length, and nearly twice the distance between the eyes below. The eyes, therefore, are oblique, sloping downwards and inwards, therefore better seen on a view from below than from above. Head $3\frac{3}{4}$ in length; eye nearly 3 in head.

Snout broadly rounded in front. Upper cheeks and top of head with large scales. Lower parts with small ones, appearing naked.

Fin rays D. about 7; A. 9 or 10. Fins all small except caudal and perhaps anal. Dorsal much behind anal and not half as large, its front midway between front of eye and tip of caudal. Pectorals narrow; caudal large and rounded. The fins are very fragile, so that it is almost impossible to count the rays.

Scales large, in 33 to 36 transverse rows, about 10 longitudinal ones, the scales strongly marked with concentric ridges.

Branchiostegals apparently 3. Vent a little nearer snout than base of caudal. Ventrals small and short.

Color pale olive in spirits, bluish in life; a brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales. About 10 of these lines, which are very distinct, a little wider forwards, narrower than the interspaces.

Males (?), with these lines interrupted and further marked with about 9 crossbars, not one-third as wide as the interspaces, obscure forwards, most distinct over anal.

Length of all adult specimens seen, just $1\frac{1}{2}$ inches.

Habitat. Rivers and lakes of N. Ind. and Illinois. Abundant wherever noticed. They swim about near the surface, slowly, as if it were very hard work.

This species bears little resemblance to *Z. notatus*, the type of *Zygonectes*. This latter species is Rafinesque's "*Semotilus? notatus.*" I have accordingly substituted the name of *notatus* for *olivaceus*, Storer. I have also substituted *Fundulus diaphanus*

for *F. multifasciatus*. Le Sueur's type of his *Hydrargira diaphana* and *multifasciata* both came from Saratoga Lake, and his descriptions apparently refer to the same species. *Diaphanus*, Le Sueur, is the name first used. *Fundulus diaphanus* is the most widely diffused of all our Cyprinodonts, occurring in brackish water as well as in ponds and springs, from Massachusetts to Colorado.

Zygonectes is not well distinguished from *Haplochilus*, McClelland. *Micristius*, Gill, is probably a synonym.

16. **Fundulus menona**, Jor. and Copeland, sp. nov.

Among the fishes sent to us by Dr. Hoy is a species of *Fundulus*, which seems to be new to science. It is characterized as follows:—

Body elongate, slightly compressed, not elevated, its depth 5 in length. Head long and large, $3\frac{2}{5}$ in length, flat on top, and rather narrow, the breadth of interorbital space half greater than width of eye. Eye 4 in head.

Mouth moderate, of the usual form. Length of head $1\frac{3}{4}$ in distance to dorsal.

Fin rays D. 12; A. 10; V. 6; B. 5.

Dorsal in advance of anal moderately long, and not very high. Anal short and very deep, the longest ray $\frac{2}{3}$ the length of the head. Pectorals short, reaching ventrals; ventrals short, scarcely reaching anal. Vent midway between front of eye and base of caudal.

Scales moderate, in 48 transverse rows, and about 12 longitudinal ones, not small, but very closely imbricated.

Color in spirits dark olive brown, with numerous narrow vertical silvery bands, or dark olive above, this color extending down the sides and around the belly, forming 16 bands, which are separated by shining, silvery interspaces, which are narrower than the bands, and very distinct. The dark spaces are broadest behind. Cheeks and opercle silvery. Traces of dark lines along the rows of scales. Fins unspotted.

Length $3\frac{1}{4}$ inches.

Habitat. Catfish River, Dane Co., Wisconsin (outlet of Lake Menona near Madison).

This species is most nearly related to *Fundulus diaphanus* (*multifasciatus*). The latter, however, differs entirely in coloration, being silvery olive, with narrow black bars, and the dorsal region irregularly spotted. *F. menona* further has the head longer and

narrower, the scales rather larger and more closely imbricated. The vent in *F. diaphanus* is about midway between the middle of caudal and the front of eye. *F. menona* perhaps reaches a larger size than the other species.

17. **Dorosoma cepedianum** (Le S.), Gill.

This species is now abundant in Lake Erie and Lake Michigan, as well as in the larger tributaries of the Mississippi River. It has come into the great lakes through the canals. As a help to the settlement of the question of the relation of the western fish (*Dorosoma notatum*, Raf., *Chatoëssus ellipticus*, Kirt.) and the eastern one, I give here a detailed account of the specimen in the Indiana collection from the Wabash River, at Merom.

Body deep, much compressed, but not greatly elevated. Mouth small, inferior, snout rounded. Depth $2\frac{1}{3}$ in length, without caudal. Head 4. Eye twice length of snout, $4\frac{1}{2}$ in head. Length of top of head $3\frac{1}{4}$ in distance to origin of dorsal.

Fin rays D. II., 11; A. II., 30; V. 8.

Scales in about 56 transverse rows and 20 longitudinal ones. 17 scutes in front of ventral fins, 12 behind.

Dorsal fin beginning midway between snout and middle of base of caudal, the last or filamentous ray being equal to the length of the head, nearly twice the length of the longest ray not filamentous, and more than twice the base of the fin. Pectorals scarcely reaching ventrals, $1\frac{1}{4}$ in head. Ventrals reaching half way to anal, $2\frac{1}{6}$ in head. Vent about midway between snout and tip of caudal. Anal base a little longer than head, three times its longest ray. Caudal fin widely forked, largely scaly at base. Depth of caudal peduncle half length of head.

In spirits, nearly uniformly silvery.

Length of specimen $10\frac{1}{2}$ inches.

18. **Esox salmoneus**, Raf.

I have adopted Rafinesque's name for the common Little Pickerel of the Western States, because it is undoubtedly the species which Rafinesque had in mind, notwithstanding his statement that "it reaches the length of five feet." *Esox umbrosus*, Kirtland, is the same fish, as I know from the examination of his original type. Some of Le Sueur's unidentified species probably belong here.

Esox cypho, Cope, of which I have examined specimens from

Fox River, Illinois, is quite distinct. It is locally known as the Buffalo Pike.

Rafinesque's name, *Picorellus*, may be used for the species of *Esox*, with the cheeks and opercles entirely scaled. It is equivalent to the group "Pickerels" of Girard. This character is, however, hardly of generic value.

19. **Minnilus ariommus**, Cope.

This species is locally quite abundant in White River, about Indianapolis, in which stream Cope's original type was taken. I have, however, not found it in any other river, nor in any of the tributary creeks. It is a rather large and striking species. In size of eye it surpasses all of our other *Cyprinidæ*.

20. **Lythrurus cyanocephalus**, Copeland, MS., sp. nov.

"*Hoy's Red Fish.*" Hoy in Reports on Fishes of Wisconsin.

Lythrurus cyanocephalus, Copeland, MS., Nelson, Bull. Ills. Mus. Nat. Hist., 1876. (Name only.)

Among the unfinished papers of the late Prof. Copeland, are fragments of a synopsis of the Fishes of Wisconsin. In this MS. "Hoy's Red Fish" is described under the above name, from specimens sent by Dr. Hoy, and from others examined from Bass Creek, near Hanover, Wis. The following is Prof. Copeland's description, with a few additional characters taken from the type specimens which are now in my possession.

Body short, stout, deep, chubby, moderately compressed, the depth about 4 in length; dorsal outline elevated, the axis of the body being about half nearer the ventral outline than the dorsal, so that the form is quite unlike that of *L. diplæmius*. Caudal peduncle rather short, not specially contracted.

Head very short, deep, $4\frac{1}{8}$ to $4\frac{1}{4}$ in length, its greatest depth $1\frac{1}{3}$ in its length, equal to the distance from front of eye to edge of opercle. Snout blunt, shorter than eye. Mouth large, very oblique; more so than in any of the others, its angle fully 45°. Lower jaw longest. Maxillary reaching to opposite anterior border of eye. A slight occipital depression. Interorbital space wide, wider than eye. Eyes large, $3\frac{1}{3}$ in head.

Fin rays D. I. 8; A. I. 11 in one, I. 12 in others.

Fins large. Dorsal well behind ventrals, with a large black spot which involves the bases of the anterior rays, the whole spot about equal to the eye in extent. Longest dorsal ray about equal to head. Pectorals rather short and broad, not reaching ventrals.

Ventrals shortish, reaching anal. Anal long and high, its free border concave. Dorsal considerably nearer caudal than snout. Ventrals a little nearer snout than caudal.

Lateral line with 46 scales, 9 rows above and 4 below it. Scales small, much crowded anteriorly. Lateral line strongly decurved, forming a broad and regular arc from opercle to opposite end of dorsal, thence nearly straight to the tail. Dorsal scales small. Region anterior to ventrals mostly naked.

Whole top of head, lower jaw, lower part of cheeks, subopercle, muzzle, whole region anterior to dorsal fin and down the sides nearly to the pectorals, studded with small whitish tubercles in the type specimens, which are spring males.

These prominences are smaller and more crowded than in *diplæmius*. In addition, minute asperities occur on the scales of the sides and about the ventral fins.

Color in spirits dark bluish above, pale below, not silvery. In life, males with the sides and fins clear bright red, back and especially the top of the head, a bright glaucous blue. Females probably pale olivaceous.

Length $2\frac{1}{2}$ inches. Teeth 2, 4–4, 2, as in *L. diplæmius*.

Habitat. Root R., Racine Co., Wis. (Hoy). Tributary of Rock R. (Copeland).

This species has been long known to Dr. Hoy and Dr. Kirtland, but it has hitherto escaped description. Specimens were long ago sent to Girard for description, but in some way they were lost. *L. cyanocephalus* resembles *L. diplæmius*, but it is smaller and more compact, with smaller fins. Dr. Kirtland's *Leuciscus diplemius* is the male of *Luxilus cornutus* var. *gibbus*, Cope. His *Leuciscus compressus* is probably, in part at least, the female of *Lythrurus diplæmius*.

21. **Chrosomus erythrogaster**, Rafinesque.

In an unfinished MS. "Review of the genus *Chrosomus*," Prof. Copeland shows that the current species of this genus, viz., *C. erythrogaster*, Raf. (= *C. oreas*, Cope), *C. pyrrhogaster*, Jordan (= *C. erythrogaster*, Ag.), and *C. eos*, Cope., are probably forms or varieties of one species, the alleged distinctions proving quite illusive.

Highly colored males of *C. erythrogaster* from Wisconsin have the fins bright yellow, and the scales of nearly the whole body

provided with very minute tubercles, similar to those on the head of *Minnilus rubifrons*.

22. Moxostoma anisurum (Raf.).

Catostomus anisurus of Kirtland, and undoubtedly that of Rafinesque also, is the fish lately called *Ptychostomus collapsus* by Prof. Cope. *P. velatus*, Cope, seems to be the young of the same species.

23. Placopharynx carinatus, Cope.
Proc. Am. Philos. Soc. 1870.

Through the kindness of Dr. Levette, I have received a set of the pharyngeal bones of this species. A member of the Geological Survey informs me that they are found in a large, coarse species of sucker, which is common in the spring at Terre Haute and elsewhere on the Wabash. The genus and species were originally based on a single specimen, but there can be no doubt as to their validity. Since the above was written, I have seen another set of these bones from the Falls of the Ohio, and also a skull and part of the skeleton of this species, found in the Scioto R. at Columbus, Ohio, by Dr. J. M. Wheaton.

24. Carpiodes difformis, Cope.
Proc. Am. Philos. Soc. 1870.

The *Ichthyobus difformis* of Nelson (Bull. Ills. Mus. p. 49) is *Carpiodes cutisanserinus*, Cope. The two species are undoubtedly distinct, although I once held the contrary opinion.

25. Carpiodes carpio, Rafinesque.
Carpiodes nummifer, Cope. Proc. Am. Philos. Soc. 1870.

Although Rafinesque's *Catostomus* (*Carpiodes*) *carpio* is said to have 36 dorsal rays, yet his description so evidently refers to this common species, that I have adopted his specific name. I do not now think it necessary to unite *Ichthyobus* with *Carpiodes*.

26. Ichthyobus bubalus, Rafinesque.

This species, which reaches quite a large size, differs from its congeners in having the dorsal region but very little elevated, so that the axis of the body is very nearly midway between the dorsal and ventrals.

A specimen from the Wabash R., 27 inches long, and weighing 15 lbs., showed the following characters:—

Head = depth, $3\frac{1}{2}$ in length; eye, small, $6\frac{1}{2}$ in head; depth of head, $\frac{5}{8}$ its length; opercle, very wide, convex, and furrowed;

scales, very large; color, dull brownish-olive, not silvery. D. II. 27; A. I, 9; lateral line, 40.

27. **Ichthyobus cyanellus**, Nelson.
Bull. Ills. Mus. Nat. Hist. 1876, 49.

This species is undoubtedly distinct from all previously described, unless it be *I. rauchii*, Ag. Specimens from St. Louis, which I have identified as probably *I. rauchii*, differ from Nelson's types in several particulars, notably in the midway position of the dorsal. What Agassiz's *I. rauchii* and *I. stolleyi* really are, no one can tell from the descriptions.

I. cyanellus differs from *I. bubalus* in having a much deeper body, larger and higher dorsal, and smaller mouth.

28. **Ichthyobus ischyrus**, Nelson, sp. nov.

In the Illinois State Collection, Mr. Nelson has found still another species of this type, remarkable for the stout and deep body. The following description has been forwarded by him for publication:—

"This is a very stout and heavily built species. Depth, $2\frac{1}{3}$ in length; head, extremely broad between the eyes and but slightly convex; its length $3\frac{1}{2}$ times in length of body; snout, short and rounded, opercular apparatus large; depth of head, $1\frac{1}{3}$ in its length; width of head, $1\frac{1}{2}$; eye, $6\frac{2}{3}$ in head, $1\frac{2}{3}$ in snout, 4 in interorbital space; caudal peduncle a little deeper than long.

"Scales, 7–37–7, nearly uniform, a little crowded anteriorly, finely punctate. Fins, all small. Dorsal, I. 27; A. I. 8; bluish-olive above, yellowish below; fins blackish."

Type specimens $11\frac{1}{2}$ inches long, from Mackinaw Creek in Central Illinois, a tributary of Illinois R. Several younger specimens also in the State Collection.

29. **Bubalichthys altus**, Nelson, sp. nov.

"This specimen is very deep and much compressed. The back is much arched and the profile descends steeply in front to end of snout, not forming an angle with it as in many species of *Ichthyobus*.

"Depth of body, $2\frac{1}{3}$ in length; head, 4 in length; greatest thickness of body, $1\frac{2}{3}$ in length of head; depth of head, $1\frac{1}{3}$ in its length; width, $1\frac{1}{2}$ in length. Eye, $5\frac{1}{2}$ in head, $2\frac{1}{2}$ in interorbital space, which is but little rounded.

"Lateral line perfectly straight from upper edge of opercle to caudal.

"Scales, 8–35–5. Dorsal I. 25; A. I. 9.

"Color in spirits, dull yellowish-olive; fins dusky.

"Type specimen 12 inches long, in Ills. State Museum, from Cairo, Illinois."

The type specimen I have examined. It is certainly distinct from *B. bubalus*, Ag., and still more so from *B. niger*. *B. vitulus*, Ag., as far as one can tell, judging from the very superficial description, is also different. The most striking characters of *B. altus*, are the great depth and compression of the body.

30. **Bubalichthys bubalus**, Agassiz.

? Catostomus bubalus, Kirtland, Bost. Journ. Nat. Hist. (not of Rafinesque).

Bubalichthys bubalus, Agassiz, Am. Journ. Sc. Arts, 1855.

Four specimens of this species from the Mississippi River at Quincy, Illinois, show the following characters:—

Body considerably elevated and compressed above; the dorsal region sub-carinate; belly thicker. Depth $2\frac{3}{4}$ in length. Axis of the body above the ventrals, below the lateral line and nearly twice as far from the back as the belly. Greatest depth of body at beginning of dorsal, which is in advance of ventrals, and a trifle nearer the snout than the caudal.

Head wide, rounded across the top, wider above eyes than across cheeks. Interorbital space 2 in head. Head 4 in length of body, its greatest depth $1\frac{1}{8}$ in its length. Eye = snout 4 in head, much larger than in *B. niger*.

Mouth small, notably smaller than in *B. niger*, and with thinner lips, which are granulated and feebly plicate. Mandible about equal to eye. Humeral and suborbital bones slightly different from those of *B. niger*, quite unlike those of "*I. rauchii*."

Pharyngeal bones very strong, with large teeth, which grow larger downward. Intestinal canal long, longer than body.

A decided occipital depression. Head triangular in outline, viewed from the side. Ante-orbital region strongly elevated and curved; length of top of head $2\frac{3}{4}$ in distance from snout to occiput. Nostrils large.

Scales 8–40–6 in two specimens, 8–39–6 in one, 7–39–5 in the fourth.

Fin rays, D. I. 28 in two, I. 29 in rest. A. I. 10, V. i. 10.

Dorsal elevated in front and rapidly declined, the seventh ray half the length of the third or longest. The latter reaches to the base of the 18th ray, or more than half the base of the fin. Anal reaching caudal, its rays rapidly shortened. Pectorals shorter than anal, anal than ventrals, all than head.

Length of specimens, three, 12½ inches, the fourth 12 inches. The species probably does not reach a large size.

It is probably best to retain the name *bubalus* for this fish, although it is perhaps doubtful whether it is really Agassiz's species, still more doubtful whether it is Kirtland's *C. bubalus*, and finally it is certainly not Rafinesque's *C. bubalus*, which is an *Ichthyobus*.

31. **Bubalichthys niger** (Rafinesque), Agassiz.

?? Catostomus (Ictiobus) niger, Raf. Ich. Ohi., 1820, 56.

Bubalichthys niger, Am. Journ. Sc. Arts, 1855.

My specimens undoubtedly belong to Agassiz's *B. niger*, but Rafinesque's "entirely black, lateral line straight," are hardly sufficient to characterize his species.

Body much less elevated and less compressed than in *B. bubalus*, the back not at all carinated. Axis of body over the ventrals about at the lateral line, and but an eighth or tenth further from the dorsal line than the ventral. Greatest depth midway of body over ventrals and just in advance of dorsal. Depth 3⅓ in length.

Head strongly transversely convex, almost ridged above, in length, less narrowed downwards than in *bubalus*. Greatest depth of head 1⅓ in its length. Interorbital space 2⅓. Eye = snout 5½ in head, much smaller than in *bubalus*. Snout scarcely projecting. No depression at occiput. An almost even curve from snout to dorsal. Head bounded by curves, therefore not triangular, thicker, larger, and less pointed than in *bubalus*.

Mouth large, with a large and pappillose lower lip. Mandible longer than eye.

Scales 8–41–7.

Fin rays D. I. 30, A. I. 11.

Dorsal not so high nor so rapidly depressed as in *bubalus*, the longest ray scarcely half the length of the base of the fin, reaching to the 15th, the 9th ray, half the height of the first. Anal reaching caudal, its middle rays more rounded, not so much shorter than the first. Pectorals as long as ventrals, both longer than anal and less than head.

Color as in other species of *Ichthyobus* and *Bubalichthys*, but darker. Fins all black.

Length of specimen, from which above measurements are taken, 14 inches.

Habitat. Quincy, Illinois.

SUPPLEMENT.

Revision of Genera and other Ichthyological matters.

XENOTIS, Jordan, gen. nov.

I have for some time noticed a striking difference in the character of the appendages to the anterior branchial arches in the different genera of sunfishes. In *Pomotis*, and part of the species of *Lepomis*, these appendages are soft, short, and blunt, similar to those on the other gill arches. In the other genera, one of the rows on the anterior arch is considerably modified—those on the lower part of the arch, at least, being stiffer, more slender, and very much longer than those in *Pomotis*. This character seems to me a very important one, and one of generic value. In this view I am supported by Prof. Cope.

The original type of *Lepomis*, Raf., was *Labrus auritus* of authors, which, with Prof. Gill, I identify as *Ichthelis rubricauda*, Holbrook, one of the species with long gill appendages. The name *Lepomis* remains, therefore, for those species with the gill rakers long.

For the species of the old genus *Lepomis*, with the gill appendages short, I would propose the name of *Xenotis*. The type of *Xenotis* is *Pomotis fallax*, B. & G. The full generic characters are given above.

The following species have been examined with reference to this character:—

Appendages long (*Lepomis*).	Appendages short, undifferentiated (*Xenotis*).
Auritus, Linné (type).	Fallax, B. & G. (type).
Appendix, Mitchill.	Sanguinolentus, Agassiz.
Incisor, Cuv. & Val.	Megalotis, Raf.
Speciosus, B. & G.	Nitidus, Kirtland.
Obscurus, Ag.	Inscriptus, Agassiz.
Aquilensis, Grd.	Breviceps, B. & G.
Anagallinus, Cope.	Popii, Grd.
Oculatus, Cope.	
Nephelus, Cope.	

The following are the changes in nomenclature in the *Centrarchidæ* which are considered necessary by Prof. Cope and the writer:—

(*a*) *Pomotis*, Cuvier, for *Pomotis*, Raf. (1819). Rafinesque's name can only be considered as a synonym of his own *Lepomis*. *Pomotis*, if used at all, must stand as characterized by Cuvier, who proposes it as a new genus, and makes no direct allusion to Rafinesque. It does not seem necessary to coin a new name for this group.

(*b*) *Apomotis*, Raf. 1819, for *Telipomis*, Raf. 1820 (Nelson emend.). *Apomotis* was based on two species, *cyanellus* and *macrochirus*, the first of which seems to belong to this genus as emended by us. In the Ichthyologia Ohiensis, the name *Apomotis* was without reason changed to *Telipomis*. The species referred by Cuvier to *Bryttus* probably belong to *Apomotis*, but, as no American author has recognized any of them, that point must at present remain undecided.

(*c*) *Calliurus*, Raf. 1819, for "*Micropterus*, Lacépède, 1800" (Gill emend.) = *Grystes*, *Huro*, *Dioplites*, etc., auct. Lacépède's original description of his *Micropterus dolomieu* is absurd, but his figure bears some resemblance to the black bass. Notwithstanding the fact that Cuvier asserts that Lacépède's original specimen, then still preserved in the museum, was identical with *Labrus salmoides*, Lac., since Lacépède found teeth on the tongue, only five branchiostegals and two anal spines, Cuvier's identification was uncertain and insufficient for the preservation of the name. Cuvier himself thought the name unworthy of adoption ("Le genre et l'espèce du microptère doivent disparaître du catalogue des poissons," Hist. Nat. des Pois., vol. v. p. v. Cuv. et Val.). In view of this, Prof. Cope thinks that *Micropterus* (like *Aplocentrus*, *Pogostoma*, and *Proceros*, Raf.) should be rejected as an unidentifiable myth, and the name next in order of priority—*Calliurus*, Raf.—be adopted as the generic name for the black bass.

EPISEMA, Cope and Jordan, gen. nov.

Pharyngeal teeth with the principal series 4–4, of the raptorial type, with acute edges. Alimentary canal short. Dorsal fin standing immediately above the ventrals. Fin radii normal; lips soft, not enlarged; the upper protractile; no barbels. Lateral line complete.

The above characters were formerly applied by Prof. Cope to the genus *Photogenis*, but it appears that the dorsal fin is not immediately above the ventral in *P. spilopterus*, the type, which must on this account be referred to the neighborhood of *Minnilus*.

Four of the seven species referred by Prof. Cope to *Photogenis* present the characters above enumerated, and one of them, the *P. scabriceps*, is regarded as the type of the genus so defined. As the name *Photogenis* was first employed for, and has been specially attached to, the *P. spilopterus*, it cannot be used for the *P. scabriceps* and its allies, so that a new name, *Episema*, is now proposed for the latter.

The following species are at present referred to *Episema*:—

Group I. Colors transparent, without pigment; scales with usual surface exposed.

Episema leucioda, Cope.
Episema telescopus, Cope.
Episema piptolepis, Cope.
Episema scabriceps, Cope (type).

Group II. Colors pigmented, brilliant; exposed surfaces of scales more narrow and high.

Episema (?) *pyrrhomelas*, Cope.
Episema callisema, Jordan.

The species last mentioned has the teeth in a single row.

Episema may be compared with related genera as follows:—

Teeth raptatorial, with the principal series 4–4; lateral line complete; fin radii normal; no barbels; lips soft, not enlarged.

a. Teeth with masticatory surface developed.
b. Dorsal decidedly posterior to ventrals. LYTHRURUS.
bb. Dorsal over ventrals.
d. Scales normal. HYBOPSIS.
dd. Scales closely imbricated, the exposed surfaces high and narrow. LUXILUS.
aa. Teeth with the edges crenate. CYPRINELLA.
aaa. Teeth entire without masticatory surface.
e. Dorsal over ventrals. EPISEMA.
ee. Dorsal behind ventrals. MINNILUS.

Moniana, Grd., is not generically distinct from *Cyprinella*. *Codoma* and *Cliola* are, perhaps, synonymous with *Minnilus*. *Tigoma* is an "*omnium gatherum*," the precise value of which is not yet determined.

Minnilus xanurus, Jordan, sp. nov.

Form moderately elongated, subfusiform, heavy forwards; the head being decidedly like *Luxilus*. Depth 4⅓ in length.

Head stout, somewhat elongated, about 4 in length, the snout but slightly overlapping the large, oblique mouth; the maxillary reaching the orbit. Head roundish above in males, with many small, whitish tubercles, not much crowded, and arranged somewhat in rows—one or two rows of these extend backwards to the dorsal; several series of strong tubercles on each side of caudal peduncle; one along each row of scales. These are very striking, and are apparently characteristic of this species.

Scales high, closely imbricated, as in *Luxilus cornutus*, dark edged, being punctate with black. Lateral line with 37 scales (36 to 39).

Color dark-steel blue; silvery below; a faint black spot at base of caudal. Fins mostly bright crimson red in males, the dorsal largely black on its upper posterior part. Dorsal, anal, and caudal tipped with white pigment; belly, base of anal, ventral and pectoral fins with white pigment.

Eye large, 3¾ in head.

Dorsal low, 5½ in length of body. Caudal fin large. Fin rays: dorsal 1.8; anal 1.11 (1.10). Length 3 to 3¼ inches.

Teeth 1, 4–4, 1, hooked, entire, without masticatory surface.

Hab. South Fork of the Ocmulgee River, at Flat Shoals, De Kalb Co., Georgia.

This species is one of the most beautiful of the *Cyprinidæ*. The long anal fin and the presence of rows of tubercles on the caudal peduncle are striking characters. The latter feature suggests the specific name (*xaino*, to scratch). It resembles *Episema pyrrhomelas*, Cope, but is distinguished at once by the generic character of the backward dorsal.

This species belongs to the subgenus of *Minnilus*, which has been called *Photogenis*. The following are the species of *Minnilus* as at present understood—several species now referred to other genera probably also belong here:—

Subgenus MINNILUS: colors transparent; little or no pigment; scales normal.

Minnilus arge, Cope.
Minnilus dinemus, Raf. (type of genus).
Minnilus jemezanus, Cope.

Minnilus lepidulus (Grd.), C. & J.
Minnilus micropteryx, Cope.
Minnilus matutinus, Cope.
Minnilus rubellus (Ag.), C. & J.
Minnilus dilectus (Grd.), C. & J.
Minnilus amœnus (Abbott), C. & J.
Minnilus megalops (Grd.), C. & J.
Minnilus amabilis (Grd.), Nelson.
Minnilus socius (Grd.), C. & J.
Minnilus stilbius, Jordan.
Minnilus umbratilis (Grd.), C. & J.
Minnilus percobromus, Cope.
Minnilus rubrifrons, Cope.
Minnilus altipinnis, Cope.
Minnilus oligaspis, Cope.
Minnilus simus, Cope.
Minnilus ariommus, Cope.
Minnilus photogenis, Cope.

Subgenus PHOTOGENIS: colors brilliant, pigmentary; scales imbricated, so that the exposed surfaces are high and narrow.

Minnilus spilopterus, Cope.
Minnilus analostanus (Grd.), C. & J.
Minnilus eurystomus, Jordan.
Minnilus callistius, Jordan.
Minnilus stigmaturus, Jordan.
Minnilus cœruleus, Jordan.
Minnilus xænurus, Jordan.
Minnilus lirus, Jordan.

The last species has the teeth 2, 4–4, 2, as in *Lythrurus;* the other colored species 1, 4–4, 1.

Certain species of *Ceratichthys*, Baird, were separated from that genus under the name of *Nocomis*, Girard, before *Ceratichthys* itself had ever been characterized. It seems necessary therefore to substitute *Nocomis* for *Ceratichthys.*

Moxostoma anisurum, Raf.

Catostomus (*Moxostoma*) *anisurus*, Raf. Ich. Oh. (not of Ag.).
Catostomus anisurus, Kirt. Bost. Journ. Nat. Hist.

Prof. Cope, after examination of one of my specimens of this species, dissents from my identification of *Ptychostomus collapsus*, Cope, with it, considering the *anisurum* a related species, previously unknown to him. I therefore give its full characters, leaving the matter for further investigation.

Body compressed, short and stout, the back strongly elevated. Depth 3⅗ in length, without caudal.

Head 4⅓ in body, short and thick, with vertical cheeks and a broad, flat, and steep interorbital space. Interorbital space equal to snout, 2¼ in head. Eye midway of head, 4 in length of head. A prominent depression across nose.

Mouth very small, the lower lip small, infolded, and Λ-shaped behind.

Pectorals small, reaching two-thirds the distance to the ventrals. Dorsal large; its height ⅝ length of head; its last ray half-way between snout and base of caudal. Eyes large and high up.

Scales 5–44–4.

Fin rays: D. 1.15; A. 1.8; V. 9.

Color pale olivaceous; sides silvery; dorsal and caudal dark; lower fins orange.

Specimen described 12 inches long, from Lake Erie, at Toledo, Ohio.

Genera of Catostomidæ.

The genera of *Catostomidæ*, accepted by Prof. Cope and the writer, may be thus compared:—

* Body oblong or elongate, with a short, subquadrate dorsal fin of 10 to 17 developed rays (*Catostominæ*, Gill).

† Air-bladder in three parts; lateral line present; fontanelle present; scales large, subequal.

a. Pharyngeal bones very broad and strong; the lower 7 to 10 teeth on each side, greatly enlarged, smooth, and truncate above; the teeth on the upper part of the bone small, as usual in the family. PLACOPHARYNX, 1.

aa. Pharyngeal bones not specially enlarged; the teeth of the usual type. MOXOSTOMA, 2.

†† Air-bladder in two parts.

b. No lateral line; fontanelle present. ERIMYZON, 3.

bb. Lateral line well developed.

c. Fontanelle distinct. CATOSTOMUS, 4.

cc. Fontanelle obliterated by the union of the parietal bones. PANTOSTEUS, 5.

** Body much elongated, subcylindrical forwards; dorsal elongate, falciform, of 30 or more rays; fontanelle obliterated by the union of the parietal bones (*Cycleptinæ*, Gill).

d. Mouth small, subinferior, with pappillose lips. CYCLEPTUS, 6.

*** Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present (*Bubalichthyinæ*, Gill).

e. Pharyngeal bones narrow, with the teeth relatively thin and weak.

f. Mouth small, inferior, protractile downwards; fins often greatly elevated. CARPIODES, 7.

ff. Mouth larger, subterminal, protractile forwards (species of larger size, dusky colors, with lower dorsal). ICHTHYOBUS, 8.

ee. Pharyngeal bones strong; the teeth comparatively coarse and large, increasing in size downwards; dorsal fin moderately elevated; mouth inferior. BUBALICHTHYS, 9.

Of the above genera, *Carpiodes* and *Ichthyobus* are doubtfully distinct, such species as *C. carpio* connecting them closely.

Moxostoma, Rafinesque, 1820 (Jordan emend. 1876) is equivalent to *Ptychostomus*, Agassiz, 1854 = *Teretulus*, Cope, 1868. *Moxostoma*, Raf., is based on two species: *Catostomus anisurus* and *C. anisopterus*. The latter, described "from a drawing by Mr. Audubon," is unrecognizable or mythical; the former is a common species of "Red Horse," although Agassiz strangely misconstrued both Rafinesque's and Kirtland's descriptions of it. For *C. anisurus* and its numerous congeners, the name *Moxostoma*, having clear priority, must obviously be retained.

ON THE GENERA OF NORTH AMERICAN FRESH-WATER FISHES.

BY DAVID S. JORDAN AND CHARLES H. GILBERT.

In the present paper, the authors design to give in strict chronological order the names of all the genera thus far proposed which have been based on species of North American fresh-water fishes.

In the chronological catalogue is given under the head of each genus (*a*) its author, (*b*) the place where it was first proposed, and (*c*) its type species. In case no species is designated, either explicitly or virtually, as the type of a genus, the species first mentioned as belonging to it is, according to general custom, considered as the intended type.

A discussion of synonyms is next given; and, finally, an alphabetic list of genera with the etymology of generic names completes the paper.

No distinction has been here made between names proposed for "genera" and for "subgenera." Most modern "subgenera" have been at some time regarded as "genera," and most "subgenera" have been proposed in the expectation that future writers would elevate them to generic rank.

Generic names used without any sort of definition (e. g., *Cheilobus*, *Glanis*, *Miniculus*, *Oplictis*, *Leptostoma*, etc., of Rafinesque, Am. Monthly Magazine) have been left unnoticed, except in cases (e. g., *Apeltes*, Dekay, *Pygosteus*, Brevoort) where reference to some previously known species as the type is in itself a sort of characterization.

The authors have endeavored to ensure accuracy in quotations. A few works, not at present accessible to them, have been cited at second hand. These cases are designated by the use of quotation marks.

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1859.	Synechoglanis, Gill, Ann. N. Y. Lyceum Nat. Hist. S. beadlii, Gill, 1859.	40
1860.	Stenodus Richardson. ———. Salmo Mackenzii Rich. 1823.	
1860.	Asproperca Heckel. Syst. der Percoiden. A. zebra Heckel. Mss.	311
1860.	Ptyonotus, Günther, Catalogue of Fishes II. Triglopsis thompson[illegible]51.	175

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1860.	Potamocottus, Gill, Proc. Boston Soc. Nat. Hist. P. punctulatus, Gill, 1860.	41
1860.	Girardinichthys, Bleeker, "Cyprinodonts." G. innominatus, Bleek. 1860.	481
1861.	Archoplites, Gill, Proc. Acad. Nat. Sc. Phila. Ambloplites interruptus, Girard, 1859.	165
1861.	Platygobio, Gill. Pogonichthys communis, Grd. 1854.	
1861.	Pygosteus, Brevoort, in Gill's Cat. of Fishes of East Coast. Gasterosteus occidentalis, Cuvier and Valenciennes, 1829.	39
1862.	Entosphenus, Gill, Proc. Acad. Nat. Sc. Phila. Petromynon tridentatus, Baird.	331
1862.	Hypsifario, Gill, Proc. Acad. Nat. Sci. Phila. Salmo kennerlyi, Suckley.	331
1863.	Nothonotus, Agassiz, in Putnam's Bull. Mus. Comp. Zool. I. Etheostoma maculata, Kirtland, 1838.	3
1863.	Microperca, Putnam, Bull. Mus. Comp. Zool. I. M. punctulata, Put. 1863.	4
1863.	Hololepis, Agassiz, in Putnam's Bull. Mus. Comp. Zool. I. Boleosoma barrattii, Holbrook, 1855.	4
1863.	Cottogaster, Putnam, Bull. Mus. Comp. Zool. I. Boleosoma tessellatum, Thompson, 1853.	4
1863.	Pleurolepis, Agassiz, Bull. Mus. Comp. Zool. I. Etheostoma pellucidum, Baird Mss. 1863.	5
1868(?).	Schilbeoides, Bleeker, "Act. Soc. Sc. Indo-Nederl. IV." Siluris gyrinus Mit. 1818.	258
1864.	Mesogonistius, Gill, Am. Journ. Sc. and Arts. Pomotis chætodon, Baird, 1855.	92
1864.	Enneacanthus, Gill, Am. Journ. Sc. and Arts. Pomotis obesus, Girard, 1844.	92
1864.	Acantharchus, Gill, Am. Journ. Sc. and Arts. Centrarchus pomotis, Baird, 1855.	92
1864.	Hyperistius, Am. Journ. Sc. and Arts. Centrarchus hexacanthus, Cuvier, 1831.	92

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1864.	Chænobryttus, Gill, Am. Journ. Sc. and Arts. Calliurus melanops, Girard, 1857.	92
1864.	Eucentrarchus, Gill, Am. Journ. Sc. and Arts. Perca iridea, Bosc. 17— (no descr.).	93
1864.	Gronias, Cope, Proc. Acad. Nat. Sc. Phila. G. nigrilabris, Cope, 1864.	231
1865.	Ericymba, Cope, Proc. Acad. Nat. Sc. Phila. E. buccata, Cope, 1865.	88
1865.	Stilbius, Gill, Canadian Naturalist. Cyprinus americanus, Lacépède, 1800.	18
1865.	Micristius, Gill, Canadian Naturalist. Fundulus zonatus, Cuvier and Valenciennes.	24
1866.	Luciotrutta, Günther, Catalogue Fishes VI. Salmo mackenzii, Richardson, 1823.	164
1866.	Limnurgus, Günther, Catalogue Fishes VI. L. variegatus, Gnthr. 1866.	309
1866.	Photogenis, Cope, Trans. Am. Phil. Soc. P. spilopterus, Cope, 1866.	378
1867.	Phenacobius, Cope, Proc. Acad. Nat. Sc. Phila. P. teretulus, Cope, 1867.	96
1869.	Hemioplites, Cope, Journ. Acad. Nat. Sc. Phila. H. simulans, Cope, 1868.	217
1870.	Hypohomus, Cope, Proc. Am. Phil. Soc. Cottogaster aurantiacus, Cope, 1870.	449
1870.	Labidesthes, Cope, Proc. Am. Phil. Soc. Chirostoma sicculum, Cope, 1865.	455
1870.	Hemitremia, Cope, Proc. Am. Phil. Soc. H. vittata, Cope, 1870.	462
1870.	Placopharynx, Cope, Proc. Am. Phil. Soc. P. carinatus, Cope, 1870.	467
1872.	Coliscus, Cope, Hayden's Geol. Sur. Wyoming, 1870. C. parietalis, Cope, 1872.	437
1872.	Sarcidium, Cope, Hayden's Geol. Sur. Wyoming, 1870. S. scopiferum, Cope, 1872.	440
1872.	Apocope, Cope, Hayden's Geol. Sur. Wyoming, 1871. A. carringtonii, Cope, 1872.	472
1872.	Protoporus, Cope, Hayden's Geol. Sur. Wyoming, 1871. P. domninus, Cope, 1872.	473

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1872.	Myloleucus, Cope, Hayden's Geol. Sur. Wyoming. M. pulverulentus, Cope, 1872.	475
1873.	Plesioperca, LeVaillant, Nouvelles Archives du Museum. P. anceps, LeV. 1874.	36
1873.	Astatichthys, LeVaillant, Nouv. Arch. Mus. Etheostoma cærulea, Storer, 1845.	106
1874.	Plagopterus, Cope, Proc. Am. Phil. Soc. P. argentissimus, Cope, 1874.	130
1874.	Lepidomeda, Cope, Proc. Am. Phil. Soc. L. vittata, Cope, 1874.	131
1876.	Erimyzon, Jordan, Bull. Buff. Nat. Hist. Soc. Cyprinus oblongus, Mitchill, 1815.	95
1876.	Eritrema, Cope, Lieut. Wheeler's Survey west of 100th meridian. Apocope henshavii, Cope, 1876.	645
1876.	Pantosteus, Cope, Lieut. Wheeler's Survey west of 100th meridian. Minomus platyrhynchus, Cope, 1874.	673
1876.	Glossoplites, Jordan, Manual Vertebrates, E. U. S. Calliurus melanops, Girard, 1857.	233
1876.	Eutychelithus, Jordan, Manual Vertebrates, E. U. S. Corvina richardsonii, Cuvier and Valenciennes, 1830.	242
1876.	Eucalia, Jordan, Manual Vertebrates, E. U. S. Gasterosteus inconstans, Kirtland, 1840.	248
1876.	Lythrurus, Jordan, Manual Vertebrates, E. U. S. Semotilus diplemius, Rafinesque, 1820.	272
1876.	Erinemus, Jordan, Manual Vertebrates, E. U. S. Ceratichthys hyalinus, Cope, 1869.	279
1876.	Sternotremia, Nelson, Bull. Ill. Mus. Nat. Hist. S. isolepis, Nelson, 1876.	39
1876.	Copelandia, Jordan, Bull. Buff. Soc. Nat. Hist. C. eriarcha, Jord. 1876.	137
1876.	Xenisma, Jordan, Bull. Buff. Soc. Nat. Hist. X. stellifera, Jord. 1876.	142
1876.	Scaphirhynchops, Gill, Mss. in Jordan and Copeland Bull. Buff. Soc. Nat. Hist. Acipenser platorynchus, Rafinesque, 1820.	161

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1877.	Imostoma, Jordan, Proc. Acad. Nat. Sc. Phila. Hadropterus shumardii, Grd. 1859.	49
1877.	Xenotis, Jordan, Proc. Acad. Nat. Sc. Phila. Pomotis fallax, B. & G. 1854.	76
1877.	Episema, Cope & Jordan, Proc. Acad. Nat. Sc. Phila. Photogenis scabriceps, Cope, 1867.	77

II. Synonyms.

The members of each of the following sets of genera appear to be founded on the same type species. In case no type is suggested by the original author, one of the species mentioned by him must be selected as the type. By the rule of exclusion, now largely adopted by systematic writers, some one of the species left after different genera may have been subtracted is to be considered as the type of the original genus, whether such type be the species first mentioned or not. Of such exact synonyms only the name first proposed should be employed, according to the rules of zoological nomenclature, unless for some reason the prior name be not available. The name to be adopted is in italics.

Type species.	*Genera.*
Etheostoma variata Kirt.,	Pœcilosoma (preoccupied), *Pœcilichthys*, Astatichthys.
Etheostoma olmstedi Storer,	*Boleosoma*, ? Arlina, Estrella.
Sciæna caprodes Raf.,	Percina, Pileoma, Asproperca.
Calliurus melanops Grd.,	*Chænobryttus*, Glossoplites.
Perca iridea Bosc.,	*Centrarchus*, Eucentrarchus.
Labrus salmoides Lac.	*Micropterus*, Calliurus, Lepomis, Aplites, Nemocampsis, Dioplites, Grystes.
Aplodinotus grunniens Raf.,	Aplodinotus (*Haploidonotus*), Amblodon.
Triglopsis thompsoni Grd.,	*Triglopsis*, Ptyonotus.
Lucania sp. incog. Grd.,	*Girardinichthys*, Limnurgus.
Percopsis guttatus Ag.,	*Percopsis*, Salmoperca.
Salmo mackenzii Rich.,	*Stenodus*, Luciotrutta.
Hiodon tergisus Le S.,	Hiodon (*Hyodon*), Glossodon (Raf.), Amphiodon, Clodalus, Glossodon (Heck.)

Type species.	*Genera.*
Cyprinus cornutus Mit.,	*Luxilus*, Hypsolepis.
Cyprinus atronasus Mit.	Arygreus (preoccupied), *Rhinichthys*.
Leuciscus argenteus Storer,	Leucosomus, Cheilonemus.
Cyprinus maxillingua Le S.,	*Exoglossum*, Maxillingua.
Cyprinus Americanus Lac.,	*Notemigonus*, Stilbe, Stilbius.
Catostomus nigricans Le S.,	Hypentelium, ? Eurystomus, Hylomyzon.
Catostomus cyprinus Le S.,	*Carpiodes*, Sclerognathus.
Silurus olivaris Raf.,	Glanis (not char.), Pylodictis (erroneous), Leptops, Opladelus (*Hopladelus*), Ilictis.
Silurus punctatus Raf.,	*Ictalurus*, Elliops.
Litholepis adamantinus Raf.,	*Litholepis*, Atractosteus.
Polyodon folium Lac.,	*Polyodon*, Spatularia, Platirostra (Planirostra).
Acipenser platyrhynchus Raf.,	Scaphirhynchus (preoccupied), *Scaphirhynchops*.
Esox osseus Linn.,	Lepisosteus (*Lepidosteus*), Sarchirus.

III. Summary.

The foregoing catalogue comprises 225 names of genera and subgenera, whereof about 128 seem to be entitled to generic rank, and the remaining 97 are either synonyms, or else entitled to use only as designations for sections and subgenera in works where the recognition of such groups by name seems desirable.

A list of the authors referred to is here given, with the number of genera proposed by each, classified as valid and invalid as above indicated. Of course, until unanimity is reached in matters of nomenclature such an arrangement is extremely arbitrary.

Authors.	*Valid Genera.*	*Subgenera and Synonyms.*	*Total.*
Rafinesque	27	36	63
Girard	25	12	37
Agassiz	17	8	25
Cope	14	4	18
Gill	8	7	15
Jordan	8	2	10
Dekay	4	4	8
Lacépède	6	..	6
Le Sueur	4	1	5
Cuvier and Valenciennes	2	4	6
Heckel	1	4	5
Baird and Girard	3	1	4
Baird	..	3	3
Bleeker	1	1	2
Günther	..	3	3
Putnam	1	1	2
Le Vaillant	..	2	2
Mitchill	2	..	2
Linnæus	1	..	1
Shaw	..	1	1
Haldeman	1	..	1
Richardson	1	..	1
Thompson	..	1	1
Ayres	..	1	1
Brevoort	1	..	1
Nelson	1	..	1
Cope & Jordan	1	..	1
Total	128	97	225

IV. Nomenclator.

1864. Acantharchus: *akantha*, spine—*archos*, anus.
1856. Acomus: vox euphon.
1855. Acrocheilus: *akros*, sharp—*cheilos*, lip.
1859. Adinia: vox euphon.
1856. Agosia: vox euphon.
1856. Alburnellus: Alburnus. (Latin, albus, white.)
1856. Alburnops: Alburnus—*ops*, appearance.

1856. Algansea: vox euphon.
1856. Algoma: vox barbar.
1859. Alvarius: vox euphon.
1859. Alvordius: Ded. to Major B. Alvord.
1819. Amblodon: *amblus*, blunt—*odōn*, tooth.
1820. Ambloplites: *amblus*, blunt—*hoplitēs*, armed.
1842. Amblyopsis: *amblus*, blunt, *opsis*, vision.
1820. Ameiurus: *a*, privative—*meiouros*, curtailed (notched).
1766. Amia: *amia*, name of some sea fish; probably Sarda pelamys.
1819. Amphiodon: *amphi*, on all sides—*odon*, tooth.
1842. Apeltes: *a*, privative—*pelte*, a shield.
1833. Aphredoderus: *aphros*, foam—*deire*, neck.
1820. Aplesion: *haploos*, single—*plēsion*, near.
1820. Aplites: *haploos*, single—*hoplitēs*, armed.
1819. Aplocentrus: *haploos*, single—*kentron*, spine.
1819. Aplodinotus: *haploos*, single—*nōtos*, back (dorsal fin).
1872. Apocope: *apokopē*, a deficiency (lateral line).
1819. Apomotis: *a*, privative—*poma*, opercle—*ous*, ear.
1861. Archoplites: *archos*, anal—*hoplitēs*, armed.
1842. Argyrea: *argureos*, silvery.
1840. Argyreus: *argureos*, silvery.
1850. Argyrosomus: *arguros*, silver—*sōma*, body.
1859. Arlina: vox euphon.
1860. Asproperca: Aspro—Perca.
1874. Astatichthys: *astatos*, inconstant, never standing still—*ichthus*, fish.
1854. Astyanax: *astuanax*, the son of Hector.
1854. Atherinopsis: *atherine*, some small fish—*opsis*, appearance (*athar*, an arrow).
1820. Atractosteus: *atraktos*, spindle dart—*osteon*, bone.
1842. Baione: *baiōn*, some small fish known to the ancients.
1859. Boleichthys: *bolis*, a dart—*ichthus*, fish.
1842. Boleosoma: *bolis*, a dart—*sōma*, body.
1831. Bryttus: *bruttō*, to growl.
1855. Bubalichthys, *boubalos*, a buffalo—*ichthus*, fish.
1819. Calliurus: *kalos*, beautiful— *oura*, tail.
1855. Campostoma: *kampē*, curve—*stoma*, mouth.
1820. Carpiodes: Lat. *carpio*, a carp.
1854. Catonotus: *kato*, low—*nōtos*, back.

1817. Catostomus: *kato*, low—*stoma*, mouth.
1829. Centrarchus: *kentron*, spine—*archos*, anus.
1853. Ceratichthys: *keras*, horn—*ichthus*, fish.
1864. Chænobryttus: *chainō*, to gape, to yawn—*Bryttus*.
1855. Cheilonemus: *cheilos*, lip—*nēma*, thread (barbel).
1856. Cheonda: vox euphon.
1854. Chologaster: *chōlos*, maimed—*gastēr*, belly (ventral fins).
1820. Chrosomus: *chrōs*, color—*sōma*, body.
1856. Clinostomus: *klinō*, to incline—*stoma*, mouth.
1856. Cliola: vox euphon.
1820. Clodalus.
1854. Cochlognathus: *kochlos*, shell—*gnathos*, jaw.
1856. Codoma: vox euphon.
1872. Coliscus: *kolos*, a deficiency.
1876. Copelandia: Ded. to Herbert Edson Copeland.
1863. Cottogaster: *kottos*, sculpin—*gastēr*, belly.
1850. Cottopsis, Cottus: *opsis*, appearance.
1819. Cycleptus: *kuklos*, circle—*leptos*, slender (small round mouth).
1820. Cylindrosteus: *kulindros*, cylinder—*osteon*, bone.
1856. Cyprinella: *Cyprinus*.
1803. Cyprinodon: *kuprinos*, carp—*odōn*, tooth.
1820. Decactylus: *dekas*, ten—*tulos*, nail (ventral rays).
1820. Dinectus: *dis*, two— *nēktēs*, swimmer.
1856. Dionda: vox euphon.
1820. Dioplites: *dis*, two—*hoplitēs*, armed.
1820. Diplesion: *dis*, two—*plesion*, near (dorsal fin).
1820. Dorosoma: *doru*, lance—*sōma*, body.
1820. Elliops: (elliptical eyes).
1864. Enneacanthus: *ennea*, nine—*akantha*, spine.
1862. Entosphenus; *entos*, within—*sphenos*, wedge.
1877. Episema: *epi*, over; *sema*, banner (dorsal fin).
1865. Ericymba: *eri*, an intensive particle—*kumba*, cavity (mucous tubes).
1876. Erimyzon: *eri*, intensive particle—*muzaō*, to suck.
1876. Erinemus: *eri*, intensive particle—*nēma*, thread (barbel).
1876. Eritrema: *eri*, intensive particle—*trēma*, aperture (pores of lateral line).
1859. Estrella: vox euphon.
1820. Etheostoma: "Various mouths" (Rafinesque).

1876. Eucalia: *eu*, intensive particle—*kalia*, nest.
1864. Eucentrarchus: *eu*, intensive particle—Centrarchus.
1820. Eurystomus: *eurus*, wide—*stoma*, mouth.
1876. Eutychelithus: *eutuchēs*, lucky—*lithos*, stone.
1818. Exoglossum: *exo*, outside—*glōssa*, tongue.
1803. Fundulus: Lat. *fundus*, bottom.
1853. Gila: Gila River.
1860. Girardinichthys: *Girardinus* (Dr. Charles Girard)—*ichthus*, fish.
1818. Glossodon: *glōssa*, tongue—*odōn*, tooth.
1840. Glossodon: *glōssa*, tongue—*odōn*, tooth.
1876. Glossoplites: *glōssa*, tongue—*hoplitēs*, armed.
1864. Gronias: *grōnē*, a cavern.
1829. Grystes: *gruzō*, to growl.
1854. Hadropterus: *hadros*, strong—*pteron*, fin.
1869. Hemioplites: *hēmi*, half—*hoplitēs*, armed.
1870. Hemitremia: *hēmi*, half—*trēma*, pore (lateral line).
1854. Herichthys: *Heros*, an allied genus—*ichthus*, fish.
1854. Heterandria: *heteros*, different—*andria*, males.
1818. Hiodon: "toothed tongue" (*os hyoides*).
1863. Hololepis: *holos*, whole—*lepis*, scale (entirely scaly).
1856. Hudsonius: Hudson River.
1828. Huro: Lake Huron.
1855. Hybognathus: *hubos*, gibbous—*gnathos*, jaw.
1854. Hybopsis: *hubos*, gibbous—*opsis*, face.
1855. Hyborhynchus: *hubos*, gibbous—*rhugchos*, snout.
1803. Hydrargira: *hudōr*, water, *arguros*, silver.
1855. Hylomyzon: *hule*, mud—*muzaō*, to suck.
1854. Hyostoma: *hus*, hog—*stoma*, mouth.
1818. Hypentelium: *hupo*, below—*pente*, five (lower lip five-lobed).
1864. Hyperistius: *huper*, above (high)—*histion*, sail (dorsal fin).
1870. Hypohomus: *hupo*, below—*homos*, even, uniform.
1862. Hypsifario: *hupsi*, high—*fario*, a brook trout.
1854. Hypsolepis: *hupsi*, high—*lepis*, scale.
1820. Ictalurus: *ichthus*, fish—*ailouros*, cat.
1820. Icthelis: *ichthus*, fish—*hēlios*, sun
1820. Ictiobus: *ichthus*, fish—*bous*, buffalo.
1820. Ilictis: *ilus*, mud—*ichthus*, fish

1877. Imostoma: *eimi*, to move, to go—*stoma*, mouth.
1870. Labidesthes: *labia*, a pair of forceps—*esthio*, to eat.
1854. Lavinia: vox euphon.
1820. Lepibema: *lepis*, scale—*bēma*, a stair (from scaly bases of fins).
1874. Lepidomeda: *lepis*, scale—Meda.
1803. Lepisosteus: *lepis*, scale—*osteon*, bone.
1819. Lepomis: *lepis*, scale—*pōma*, opercle.
1823. Leptops: *leptos*, slender—*ops*, eye.
1819. Leucops: *leukos*, white—*ops*, eye.
1843. Leucosomus: *leukos*, white—*soma*, body.
1866. Limnurgus: *limnē*, a pond.
1818. Litholepis: *lithos*, stone—*lepis*, scale.
1859. Lucania: vox euphon.
1866. Luciotrutta: Lat. *lucius*, pike—*trutta*, trout.
1820. Luxilus: Lat. *lux*, shining, light ("shiner").
1876. Lythrurus: *luthron*, blood—*oura*, tail.
1818. Maxillingua: Lat. *maxilla*, jaw—*lingua*, tongue.
1856. Meda: vox euphon.
1854. Melanura: *melas*, black—*oura*, tail.
1864. Mesogonistius: *mesos*, middle—*gōnia*, angle—*histion*, sail.
1863. Microperca: *mikros*, small—Perca (*perkē*).
1801. Micropterus: *mikros*, small—*pteron*, fin.
1865. Micristius: *mikros*, small—*histion*, sail (dorsal fin).
1820. Minnilus: Eng. minnow; Fr. *menuise;* Lat. *minus*, small.
1856. Minomus: vox euphon.
1821. Mollienesia: Ded. to Monsieur Mollien (French Minister of Finance, a patron of Péron).
1856. Moniana: *monos*, single (row of pharyngeal teeth). (?)
1814. Morone.
1820. Moxostoma: *muzaō*, to suck—*stoma*, mouth.
1855. Mylocheilus: *mulos*, millstone, grinder—*cheilos*, lip.
1872. Myloleucus: *mulos*, grinder—*leukos*, shiner.
1855. Mylopharodon: *mulos*, grinder—*pharugx*, pharynx—*odōn*, tooth.
1820. Nemocampsis: *nēma*, thread (lateral line)—*kampsos*, curved.
1856. Nocomis: "Daughter of the Moon." (Longfellow.)
1819. Notemigonus: *nōtos*, back—*hēmi*, half—*gōnos*, angle.
1863. Nothonotus: *nothos*, spurious—*nōtos*, back.

1818. Notropis: *nōtos*, back—*tropis*, keel.
1819. Noturus: *nōtos*, back—*oura*, tail.
1859. Oligocephalus: *oligos*, few (small)—*kephalē*, head.
1820. Opladelus: *hoplon*, armature—*adēlos*, invisible, concealed.
1856. Orthodon: *orthos*, straight—*odōn*, tooth.
1876. Pantosteus: *pantos*, entirely—*osteon*, bone.
1820. Pegedictis: *pēgē*, spring—*ichthus*, fish.
1842. Percina: *Perca.*
1850. Percopsis: Perca (*perkē*)—*opsis*, appearance.
1867. Phenacobius: *phenax*, deceptive—*bios*, life.
1866. Photogenis: *phōs*, light—*gennao*, to bear (born of light).
1820. Picorellus: pickerel (vernacular).
1842. Pileoma: *pileo*, to comb (ctenoid?).
1820. Pimephales: *pimelēs*, fat—*kephalē*, head.
1870. Placopharynx: *plax*, broad—*pharugx*, pharynx.
1874. Plagopterus: *plage*, a wound—*pteron*, fin.
1820. Plargyrus: *pleura*, side—*arguros*, silvery.
1818. Platirostra: *platus*, broad—Lat. *rostrum*, snout. (Vox hybrida.)
1861. Platygobio: *platus*, broad—*Gobio.*
1874. Plesioperca: *plēsion*, near—*Perca.*
1863. Pleurolepis: *pleuron*, side—*lepis*, scale.
1854. Pœcilichthys: *poikilos*, variegated—*ichthus*, fish.
1850. Pœcilosoma: *poikilos*, variegated—*sōma*, body
1798. Polyodon: *polus*, many—*odōn*, tooth.
1854. Pogonichthys: *pōgōn*, beard—*ichthus*, fish.
1819. Pogostoma: *pōgōn*, beard—*stoma*, mouth.
1820. Pomacampsis: *pōma*, opercle—*kampsis*, curved.
1820. Pomolobus: *pōma*, opercle—*lobos*, lobe.
1820. Pomotis: *pōma*, opercle—*ous*, ear.
1818. Pomoxis: *pōma*, opercle—*oxus*, sharp.
1861. Potamocottus: *potamos*, river—*Cottus.*
1820. Proceros: *pro*, before—*keras*, horn.
1872. Protoporus: *prōtos*, before—*poros*, pore.
1855. Ptychocheilus: *ptuche*, a fold—*cheilos*, lip.
1855. Ptychostomus: *ptuche*, a fold—*stoma*, mouth.
1860. Ptyonotus: *ptuon*, fan—*nōtos*, back.
1861. Pygosteus: *puge*, vent, rump—*osteon*, bone.
1819. Pylodictis: *pelos*, mud—*ichthus*, fish.
1850. Rhinichthys: *rhin*, snout—*ichthus*, fish.

1856. Richardsonius: Ded. to Sir John Richardson.
1814. Roccus: vox barbar. (Rock fish.)
1850. Salmoperca: *Salmo—Perca.*
1818. Sarchirus: *sarx*, flesh—*cheir*, hand.
1872. Sarcidium: *sarkidion*, a little lump of flesh.
1876. Scaphirhynchops: *Scaphirhynchus—ops*, appearance.
1885. Scaphirhynchus: *skaphe*, spade—*rhugchos*, snout.
1868? Schilbeoides: *Schilbe.*
1844. Sclerognathus: *skleros*, hard—*gnathos*, jaw.
1859. Scolecosoma: *skōlēx*, a worm—*sōma*, body.
1820. Semotilus: *sēma*, banner (dorsal fin)—*telia*, or some other word used by Rafinesque for "spotted."
1856. Siboma: vox euphon.
1804. Spatularia: Lat. *spatula.*
1860. Stenodus: *stenos*, narrow—*odōn*, tooth.
1820. Sterletus: Sterlet, a European sturgeon.
1876. Sternotremia: *sternon*, breast, thorax—*trēma*, vent.
1842. Stilbe: *stilbē*, to shine, to glitter.
1865. Stilbius: *stilbē*, to shine, to glitter.
1820. Stizostedion: *stizō*, to prick—*stēthos*, breast.
1820. Sturio: Lat. *sturgeon.*
1859. Synechloglanis: *sunēcho*, to repeat, to re-echo—*glanis*, the fish "Silurus."
1820. Telipomis: *telia*, "spotted" (see Semotilus)—*pōma*, opercle.
1820. Teretulus: Lat. *teres*, terete.
1856. Tiaroga: vox barbar.
1856. Tigoma: vox barbar.
1851. Triglopsis: *Trigla—opsis*, appearance.
1859. Typhlichthys *tuphlos*, blind—*ichthus*, fish.
1842. Uranidea: *ouranos*, sky, heavens—*eidō*, to gaze.
1876. Xenisma: *xenisma*, surprise.
1877. Xenotis: *xenos*, wonderful—*ous*, ear.
1854. Zygonectes: *zugos*, a yoke (in pairs)—*nēktēs*, swimmer.

LIST OF PLANTS RECENTLY COLLECTED ON SHIPS' BALLAST IN THE NEIGHBORHOOD OF PHILADELPHIA.

BY ISAAC BURK.

Since 1867, when Aubrey H. Smith, Esq., published his "Notes on some Colonies of Plants," in the Proceedings of the Academy, there have been large additions made to the number, and, as some of them are likely to become permanent colonists, and others are interesting, either from their rarity or the place of their nativity, I propose to give a list of such as have been collected since that time as far as I have been able to ascertain them.

The extensive improvements made in the lower portion of the city by the Pennsylvania Railroad and the American Steamship Company, and the consequent increase in the number of vessels required to carry away merchandise and produce, have been the means of introducing a great variety of plants, many of which exist but a single season and then disappear, whilst others maintain a foothold for a longer period.

Some which do not flower the first year were given the protection of a cool greenhouse, and in this way I have become acquainted with some very interesting plants.

Much of the land on which these improvements have been made was low marsh, which was covered with the mud dredged from the docks, and when this had attained sufficient consistency covered with any kind of ballast which could be obtained, much of it being chalk or oolite, showing that it came from British ports, and producing plants common in such localities.

To avoid repetition I have not given the native habitat of such as are common on the British coasts, whether native or naturalized, as it is reasonable to suppose we have received them from that source, but in all cases where they are not noticed in the British flora, I have endeavored to give the habitat of each species.

1. Ranunculus philonotis, Ehr. Kaighn's Point.
2. Papaver dubium, L. Kaighn's Point.
3. Papaver hybridum, L. Kaighn's Point.
4. Sisymbrium Sophia, L. Greenwich Point.
5. Sisymbrium irio, L. Kaighn's Point.
6. Erisymum cheiranthoides, L. Old Navy Yard.

7. Brassica tenuifolia, Boiss. Kaighn's and Greenwich Points.
8. Brassica monensis, Boiss.
9. Brassica erucastrum, Bull. Huds.
10. Lepidium latifolium, L.
11. Rapistrum rugosum, All.
12. Alyssum incanum, L. Berton, D. C.
13. Reseda luteola, L. Kaighn's Point.
14. Reseda lutea, L. Greenwich Point.
15. Reseda lutea var. maritima. Greenwich Point.
16. Reseda alba, L. Greenwich Point.
17. Reseda odorata, L. Greenwich Point.
18. Gynandropsis pentaphylla, D. C. Girard Point. Nat. of S. America.
19. Cleome pungens, Willd. Very abundant at Greenwich Point along with Polygonum Orientale on mud freshly dredged from the bottom of the river. S. America.
20. Silene inflata, Smith. Greenwich Point.
21. Silene noctiflora, L. Greenwich Point.
22. Lychnis vespertina, Sibth. Greenwich Point.
23. Lychnis diurna, Sibth. Greenwich Point.
24. Vaccaria vulgaris, Host. Greenwich Point.
25. Corregiola littoralis, L. Kaighn's Point. Very rare.
26. Frankenia pulverulenta, L. Kaighn's Point. A single specimen.
27. Tribulus terrestris, L. Greenwich and Kaighn's Points.
28. Malva parviflora, L. Greenwich and Kaighn's Points.
29. Sphæralcea miniata, Spach. Kaighn's Point. Nat. of South America.
30. Geraneum dissectum, L. Greenwich Point.
31. Geraneum molle, L. Kaighn's Point.
32. Oxalis corniulata, L. Greenwich Point. Bentham seems to think this has been introduced into England from America, but it appears to be much more common there than here, and Linnæus gives Italy, Sicily, and Germany as its native habitat.
33. Medicago sativa, L. Kaighn's and Greenwich. Of a weak prostrate habit. Specimens at the Centennial Exhibition, grown in Kansas, were much stouter and rigidly erect.
34. Trigonella Monspeliaca, L.
35. Trigonella ornithopodoides, L. A single specimen.
36. Lotus corniculatus, L. Kaighn's Point.
37. Trifolium hybridum, L. This appears likely to take permanent possession of the sandy soil of New Jersey, and will probably make a valuable forage plant.
38. Lathyrus aphaca, L. Kaighn's Point. A single plant.
39. Psoralea bituminosa, L. Kaighn's Point. Native of S. Europe.
40. Potentilla reptans, L. Kaighn's Point.

Point. This is described as a
States, and it is singular how it
it is possible it may have a much
ght easily be mistaken for a slender

Point.
f Southern Europe.

.. Kaighn's Point.
oint.
Nat. S. America—Brazil to Peru.
Kaighn's Point. Nat. of Chili. Interest-
rare natural order Calycerea.
aighn's Point. Nat. of the West Indies

. D. C. Kaighn's and Girard Points.
C. Both natives of Brazil.
ld Navy Yard. Native of the Southern

Kaighn's Point. South America.
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Kaighn's and Greenwich.
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ld. Greenwich.
f. Kaighn's Point.
n's Point.
Kaighn's Point.

80. Veronica hederæfolia, L.
81. Veronica Buxbaumii, Tenore. Greenwich Point.
82. Scrophularia aquatica, L. Kaighn's Point.
83. Scoparia flava, Cham. Kaighn's Point. Nat. of South America.
84. Mentha aquatica, L. Petty's Island.
85. Ballota nigra, L. Kaighn's Point.
86. Stachys annua, L. Kaighn's Point.
87. Stachys sylvatica, L. Greenwich Point.
88. Stachys arvensis, L. Greenwich Point.
89. Tournefortia heliotropioides, Hook. Kaigkn's Point. Nat. of Beunos Ayres.
90. Solanum sisymbrifolium, Lam. Native of Brazil.
91. Solanum rostratum, Dunal. Native of the Western States and Territories.
92. Solanum eleagnifolium, Cav. S. America, Mexico, and Chili.
93. Datura Metel, L. Girard Point. Nat. of East Indies.
94. Nicotiana glauca, Graham. Kaighn's Point. Nat. of Brazil.
95. Nicotiana longiflora, Cass. Kaighn's Point. Native of Chili, but naturalized to some extent in this neighborhood.
96. Hyoscyamus niger, L. Kaighn's Point.
97. Hyoscyamus alba, L. Kaighn's Point. Southern Europe.
98. Chenopodium polyspermum, L. Kaighn's and Greenwich Points.
99. Chenopodium vulvaria, L. Kaighn's and Greenwich Points.
100. Atriplex rosea, L. Greenwich, very abundant on chalky ballast, and with A. patula and A. arenaria presenting a great variety of forms.
101. Blitum maritimum, L. Greenwich Point.
102. Alternanthera achyrantha, R. Br. E. I., S. America, and Brazil.
103. Amarantus blitum, L. Greenwich Point.
104. Amarantus deflexus, L. Greenwich Point.
105. Polygonum herniarioides, Nutt. Camden. One specimen.
106. Polygonum amphibium, L., var. terrestre, Willd. Greenwich Point.
107. Rumex maritimus, L. Greenwich Point.
108. Beta maritima, L., var.
109. Euphorbia paralias, L. Girard Point.
110. Euphorbia peplis, L. Greenwich Point.
111. Euphorbia peplus, L. Greenwich Point.
112. Euphorbia segetalis, L. Greenwich Point.
113. Mercurialis annua, L. Kaighn's and Greenwich Points.
114. Carex muricata, L. Kaighn's Point.
115. Agrostis spica venti, L. Kaighn's and Greenwich Points.
116. Agrostis ovina, L. Greenwich.
117. Alopecurus pratensis, L. Greenwich.
118. Phalaris paradoxus, L. Greenwich, E. Indies, and shores of the Mediterranean.
119. Lolium Italicum, Braun. Kaighn's Point.
120. Hordeum murinum, L. Kaighn's Point.

121. Panicum colonnum, L. Nat. of India, but found in Florida by Dr. Chapman.
122. Panicum miliacea, L. Kaighn's and Greenwich Points.
123. Andropogon halapensis, L. Girard Point. Nat. of Syria.
124. Pragmitis communis, L. Kaighn's Point. If this is not a distinct species, it is a very singular variety. The whole plant is but about 2 feet high, and of a pale glaucous hue. It has been growing there for two or three years, but did not flower till this season.
125. Holcus mollis, L. Kaighn's Point.

I am under obligations to Messrs. Parker and Martindale who collected many of the plants, and to Professor Porter who assisted in naming them.

THE VALSEI OF THE UNITED STATES.

BY M. C. COOKE, M.A., A.L.S.

As a contribution towards the more complete and satisfactory knowledge of the Fungi of the United States, I have from time to time essayed the revision of particular groups, in order to bring together the determined, as well as the doubtful or uncertain species, in order to assist the student, and serve as a basis for a more perfect and critical enumeration.

The present group has been selected as having been subjected to a more critical examination than many others, and as being a large and important one in which it is probable many important additions will yet be made.

The classification adopted is a purely artificial arrangement, which it was thought would best serve the purpose which this communication had in view. It will be observed that the names of only two genera are included, namely, *Valsa* and *Melanconis*, whereas many of the mycologists of the day admit several genera, amongst which they distribute the species. A very few words of explanation will exhibit my views on this subject, with which most European mycologists are familiar.

The principles on which the new genera have been constructed are held to be unsound and delusive, inasmuch as the fundamental assumption that the character of the fructification should hold the first rank, and all other characters be subsidiary to this, tends to reduce a natural to a purely artificial system. They are also unworthy because retrogressive.

In the genus *Valsa*, for example, it has been proposed that the limits of the genus should be confined to such species as have simple sporidia. For species with uniseptate sporidia the genus *Valsaria* was first proposed. This again became modified under *Diaporthe*. This, however, did not satisfy the cravings of the supposed reformers, for after passing through almost every type of sporidia and constituting new genera for them, they reverted to the number of the sporidia contained in each ascus, and, whereas, *Valsa* was to include all octosporous species with simple spores, the species with a larger number of sporidia were to be relegated to *Valsella*.

That this view is unsound it is only necessary to refer to *Valsa*

salicina, which has sometimes a tetrasporous form, which was at one time supposed to be a distinct species under the name of *Valsa tetraspora*, and it is sometimes octosporous as in typical *Valsa salicina*. If Tulasne is right, then *Sphœria ditopa*, with its polysporous asci, is the same species as *Sphœria conformis* with octosporous asci, and both grow together on the same twig. If the proposed basis of classification be sound, then it is applicable here, and we have the same species, in two conditions, belonging to two distinct genera, which is simply an absurdity.

Without attempting here to enter into details wherefore we have rejected each individual genus, it will be sufficient to announce our faith in the sufficiency of the Friesian system based on external characters supplemented by internal structure. No objection can be urged against the artificial grouping of the members of any one genus by means of the sporidia, as adopted here, for any special purpose, provided always that no fictitious value be assigned to the groups.

The following is the order in which the species are arranged:—

VALSA, Fries, S. V. S., p. 410.

Sect. I. Sporidia hyaline.
- A. Sporidia allantoid, or sausage-shaped—minute.
  - α. Asci polysporous.
  - β. Asci octosporous.
    - * Ostiola sulcate.
      - *a*. Necks abbreviated.
      - *b*. Necks elongated.
    - ** Ostiola not sulcate.
      - *a*. Necks abbreviated.
      - *b*. Necks elongated.
- B. Sporidia allantoid, or sausage-shaped—large.
- C. Sporidia cylindrical.
- D. Sporidia fusiform.
- E. Sporidia subelliptical.
- F. Sporidia uniseptate.
  - α. Without appendages.
  - β. With appendages.
- G. Sporidia multiseptate.

Sect. II. Sporidia colored.
- A. Sporidia simple.
- B. Sporidia uniseptate.
- C. Sporidia multiseptate.
  - α. Without appendages.
  - β. With appendages.
  - γ. With transverse septa, or fenestrate.

The known species being arranged in the above order, the uncertain, or imperfectly known species, chiefly those of Schweinitz, follow in the hope that their enumeration may eventually lead to a knowledge of their fructification. Any such information derived from authentic sources will be accepted with gratitude.

Sect. I. Sporidia hyaline.

A. Sporidia allantoid (minor).

a. Asci polysporous.

1. **Valsa melastoma,** Fries S. V. S. 411; Schwz. Am. Bor. 1341; Nitschke Pyr. Germ., p. 237.

Sporidia numerous, .005 × .001 mm. On apple. Penna. (Schw.).

We have seen no American specimens, and give the characters of the fruit from Nitschke.

Valsa angulata, Fr., is more closely allied to *Diatrype*.

β. Asci octosporous.

* Ostiola sulcate.

a. Necks abbreviated.

2. **Valsa stellulata,** Fries, S. V. S. p. 411; Nike. Pyr. p. 165; Schw. Bor. 1313; Cooke Handbk. No. 2461.

Sporidia .008–.012 × .002 mm. On bark of various trees. Common. Carolina (Rav. Curt.). Penna. (Michener). Texas (Wright). New Jersey (Berk.). Ohio (Lea). New England (Sprague).—*Ravenel Fungi, Car.* i. 51.

3. **Valsa tetraplea,** B. & C.; Cooke Handbk. 2478.

Sporidia about .01 mm. long. On branches. Carolina (Curt. Rav.). New Jersey (Ellis).

Berkeley has latterly united this, or at least some forms of it, with *Valsa stellulata*.

4. **Valsa fraxinicola,** C. & Pk. in N. Y. Museum Reports.

Sporidia .008–.012; very slightly curved, amber-colored. On *Fraxinus Americana*. New York (Peck, 232). Measurements given from an authentic specimen.

5. **Valsa Berchemiæ,** Cooke in herb. (*Valsa syngenesia*, var. *Berchemiæ* Curt. in lett.)

Sporidia .008–.01 mm., pale-brownish. On *Berchemia*. Carolina (Curt. Rav. 1205). Differing in habit from *V. syngenesia*, and also from the foregoing.

6. **Valsa monticulosa,** B. & C. in herb.

Sporidia .008–.01 mm. long. On *Magnolia glauca*. Carolina

(Curt.). Sporidia from authentic specimen sent out by the late Dr. Curtis.

7. **Valsa tumidula**, C. & Pk. in N. Y. Museum Reports.

Sporidia .01–.012 mm. long, pale-brownish. On *Cratægus* and *Platanus*. New York (Peck, 266; Gerard, 35). New Jersey (Ellis). There is a distinct black line on the wood surrounding the perithecia.

8. **Valsa platani**, Schw. Am. Bor. 1372.

Sporidia .01–.012 × .003 mm., pale. On *Platanus*. Carolina (Curt. Rav. 1821). New Jersey (Ellis). New York (Peck). Habit somewhat that of *V. quaternata*; measurement given from specimen sent by Dr. Curtis.

9. **Valsa goniostoma**, B. & C. in Curt. Cat., p. 142.

Sporidia .008–.011 mm., pale-brown. On branches. Carolina (Curtis). Sporidia from specimen communicated by Dr. Curtis.

10. **Valsa rugiella**, C. & E. in Grevillea, vol. v. pp. 92.

Ostiola minute, faintly sulcate, sporidia about .006 mm. long. Asci very small, lanceolate. On *Acer rubrum*. New Jersey (Ellis 2426), with the habit of *V. tetraploa*, but with smaller sporidia.

11. **Valsa juglandina**, C. & E. in Grevillea, vol. v. pp. 92.

Perithecia, 3–5 together, rather large and prominent, with a snowy white powder about the base. Ostiola deeply sulcate. Sporidia .01–.012 × .003 mm. On *Juglans regia*. New Jersey (Ellis, 2421). Certainly not *V. juglandicola*, Schw., and distinct from *V. stellulata*, to which it is allied.

12. **Valsa leaiana**, Berk. in Hook. Lond. Journ. 1845, p. 311.

Sporidia .007 × .002 mm., pale-brown. On Hornbeam. Ohio (Lea). S. Carolina (Rav. 1364). Sporidia from authentic specimen.

13. **Valsa vitis**, Schw. Am. Bor. 1362 (not Nitschke).

Sporidia .012–.014 mm. long. On twigs of *Vitis*. New York (Peck). Penna. (Mich.). Carolina (Curt.). The *Valsa vitis*, Fckl. & Ntke. is quite a different species, although it has been referred to this for which the name of *Valsa vitigera* will have to be substituted, as Schweinitz has priority. (Grevillea v. p. 125.)

14. **Valsa cerviculata**, Fries, S. V. S. 411; Schw. Am. Bor. 1825; Ntke. Pyr. p. 174; Not Sfer. Ital. tab. 33.

Sporidia .006–.007 × .002 mm. On Hornbeam, etc. Bethlehem

(Schw.). Measurement of sporidia given from European specimens, not having seen it from the United States.

15. **Valsa radula, Pers. Syn. p.** 37; Schw. Am. Bor. 1369; Nitschke Pyr. Germ. p. 164?

Sporidia .01–.012 mm. long. On *Populus*. Carolina (Schw.). Measurements from European specimens.

16. **Valsa prunastri, Fr. S. V.** S. p. 411; Schw. Am. Bor. 1312; Ntke. Pyr. 170; Not Sfer. Ital. t. 35; Cooke Hdbk. 2460.

Sporidia .006–.008 × .0015 mm. On *Cerasus*. South Carolina (Rav. 1271; Curt. Schw.); Penna. (Schw.).

b. Necks elongated.

17. **Valsa corynostoma, B. & C.** in Grevillea, No. 871.

Sporidia .006–.008 × .0015 mm. On *Acer rubrum*. S. Car. (Rav. 1587; Curt.). Measurements from authentic specimen in herb. Berkeley.

** Ostiola not sulcate.

b. Necks abbreviated.

18. **Valsa nivea, Fr. S. V. S. p.** 224; Schw. Am. Bor. 1338; Ntke. Pyr. 224; Cooke Hdbk. 2463.

Sporidia .012–.014 × .003 mm. On *Populus* and apple. Penna. (Mich.), Carolina (Curt.), N. Eng. (Frost).

19. **Valsa leucostoma, Fr. S. V. S. p. 411; Schw. Am. Bor. 1339; Ntke. Pyr. 222; Cooke Hdbk. 2464.**

Sporidia .01–.012 × .0025 mm. On *Prunus* and *Persica*. Carolina (Curt. Rav.), Penna. (Mich.), New York (Berk.), N. Eng. (Sprague). *Ravenel's Fungi Car.* iii. 67.

20. **Valsa syngenesia, Fr. S. V. S. 411, Curt. Cat. 142; Schw. Am. Bor. 1321; Cooke Hdbk. 2462.**

Sporidia .01 mm. long. On *Rubus strigosus*. Carolina (Curt.). We have seen no American specimen. The measurements are from a British, according to Rev. M. J. Berkeley's determination. Mr. F. Currey's is a different species, with lanceolate, quadrinucleate sporidia.

21. **Valsa microstoma, Fr. S. V. S. p. 411; Schw. Am. Bor. 1342; Ntke. Pyr. 193; Cooke Hdbk. 2466.**

Sporidia .01 × .002–.0025 mm. On bark. Carolina (Schw.), Penn. (Schw.).

22. **Valsa americana, B. & C. in Grevillea 873 (probably *V. alni*, Pk.).**

Sporidia .01–.012 × .002 mm. On bark of various trees. Com-

mon. Carolina (Cut. Rav.), N. Eng. (Sprague), with the habit of *M. stilbostoma*, but with different fruit.

23. Valsa colliculus, Worms, in Fr. Sys. Myc. ii. 389.

Asci and sporidia very minute. Sporidia .005–.006 mm. long. On bark of *Pinus*. New York (Sartwell, Peck). Sporidia from specimen communicated by the late Dr. Curtis.

24. Valsa abietis, Fr. S. V. S. 412; Grevillea, v. p. 53; Ntke. Pyr. 186; Cooke Hdbk. 2473.

Sporidia .008–.009 × .0015 mm. On bark of White Cedar. New Jersey (Ellis, 2398).

25. Valsa pini, Fr. S. V. S. 412; Ntke. Pyr. 183.

Sporidia .006–.009 × .0015 mm. On bark of *Pinus*. N. York (Peck), New Eng. (Sprague). Sporidia from Fries Scler. Suec. No. 7.

26. Valsa leiphœmioides, B. & C. in Grevillea 868 (not *Cryptospora leiphœmioides* of Fuckel).

Sporidia .01 mm. long. On Oak. Carolina (Curt.), New Eng. (Sprague). The exposed ostiola, when the cuticle is stripped off, are mixed with a white powder. We have seen no specimen.

27. Valsa fulvella, B. & Rav. in Grevillea No. 870.

Sporidia .01–.014 mm. long; pale amber. On *Platanus occidentalis*. S. Carolina (Rav. 1825). Sporidia from specimen furnished by Ravenel.

28. Valsa haustellata, Fr. Sys. Myc. ii. 383; Schw. Am. Bor. 1320.

Sporidia .006–.008 × .002 mm. Rather strongly curved, amber colored. On *Alnus serrulata*, and *Ostrya virginica*. S. Carolina (Curt. Rav.), N. York (Peck). *Ravenel Fun. Car.* iii. 53.

29. Valsa liquidambaris, Schw. Am. Bor. 1352; Grevillea, v. p. 34, pl. 75, fig. 16.

Sporidia .012 mm. long. On bark of *Liquidambar*. Carolina (Curt.), N. Jersey (Ellis). This appears to be the species of Schweinitz on the faith of specimens from Dr. Curtis.

30. Valsa subclypeata, C. & Pk. in N. Y. Museum Reports.

Sporidia .01–.012 × .003 mm., very slightly curved. On *Rhododendron* and *Quercus*. New York (Peck, 341). The disk is white, surrounded by the blackened cuticle.

31. Valsa gossypina, Cooke in herb.

Sporidia minute, .005–.006 mm. long; colorless. On branches

of *Gossypium*. S. Carolina (Rav. 1387). Habit similar to that of *V. quaternata*.

32. **Valsa caryigena**, B. & C. in Grevillea, 872.

Sporidia .01–.012 mm. long. On branches of *Carya*. Penna. (Mich.), N. Jersey (Ellis?). Pustules small, in rows; covered below with the smooth bark; disk white, studded with the black ostiola. Not having seen authentic specimen, those of Ellis from New Jersey are referred doubtfully.

33. **Valsa subscripta**, Wallr. Fl. Crypt. ii. 813.

Sporidia minute. On *Robinia*. Carolina (Curt.). Hitherto we have no knowledge of this species.

34. **Valsa anomia**, Schw. Am. Bor. 1316.

Sporidia .007–.008 mm. long. On *Robinia*. Carolina (Schw.), According to Berkeley, the Schweinitzian specimens have sausage shaped sporidia, .01 mm. long. In others there are uniseptate stylospores. The above dimensions are from specimens in Herb. Berkeley.

35. **Valsa decorticans**, Fr. S. V. S. 412; Schw. Am. Bor. 1354; Ntke. Pyr. 194.

Sporidia .01–.012 × .0025 mm. On bark of *Kerria Japonica* and *Syringa*. Carolina (Curt.). We have seen no American specimens, but Nitschke gives the sporidia as .01–.012 × .0025 mm. In specimen published by Mougeot and Nestler, they are rather smaller.

36. **Valsa coronata**, Fr. S. V. S. 412; Schw. Am. Bor. 1351; Ntke. Pyr. 196; Cooke Hdbk. 2471.

Sporidia .006–.007 × .0015 mm. On *Castanea* and *Bignonia*. Carolina (Curt.). The measurements are given from European specimens.

37. **Valsa munda**, B. & C. in Grevillea, No. 864.

Asci lanceolate. Sporidia sausage-shaped. On smooth branches of *Cornus*. Alabama (Peters). Pustules completely covered by the bark, which is blackened over them, or appears black; the disk, bordered with white, being free. We have seen no specimen.

38. **Valsa orbicula**, B. & C. in Grevillea, No. 867.

Sporidia .01–.012 mm. long. On Willow. Carolina (Curt.). Minute, orbicular, showing the subjacent perithecia by transparence, but not blackened; surrounded by a black line. This species also we have not seen.

39. **Valsa tessella**, Fr. S. V. S. 411; Schw. Am. Bor. 1348; Curt. Cat. p. 142.

Sporidia .01–.012 mm. long. On willows. Carolina (Schw.), Penna. (Schw.). Sporidia from specimens derived from Fries.

40. **Valsa monadelpha**, Fr. Sys. Myc. ii. 382; Schw. Am. Bor. 1317.

Sporidia about .01 mm. long. On *Prunus*. New England (Torrey), Penna. (Schw.). Sporidia from specimens published by Desmazieres, No. 961.

41. **Valsa truncata**, C. & Pk. in N. Y. Museum Reports.

Spermatia profuse .003–.005 mm. long. Sporidia .009–.011 mm. long. On *Alnus*. New York (Peck, 35).

42. **Valsa prostans**, B. & C. in Curt. Cat.

Measurements from original specimen. Sporidia .01–.012 × .003 mm. On branches of *Nyssa*. Carolina (Curt.), New Jersey (Ellis, 2425).

We have seen no authentic specimen and no description. The dimensions of the sporidia are given from the New Jersey specimens which we have referred to this species with hesitation.

43. **Valsa ceratophora**, Tul. Fung. Carp. ii. 191; Schw. Am. Bor. 1266; Ntke. Pyr. 180; Cooke Hdbk. 2472 (*Sphæria ceratosperma*, Tode).

Sporidia .006–.008 × .0015 mm. On branches of oak, holly, etc. Carolina (Schw. Rav. 1832), New England (Frost).

44. **Valsa rosarum**, Not. Sfer. Ital. t. 42; Cooke Hbdk. No. 2472, var.

Sporidia .006 × .0015 mm. On Rose. Carolina (Rav. 1466).

The *Diatrype hystrix* of the United States is *not* the *Valsa longirostres*, Tulasne.

46. **Valsa pulchella**, Fr. S. V. S. 412; Schw. Am. Bor. 1380; Cooke Hdbk. 2481. *Calosphæria princeps*, Ntke. Pyr. 91.

Sporidia .006 × .0015 mm. On bark of cherry, peach, etc. Carolina (Curt.), New York (Gerard, 72). *Ravenel, Fun. Car.* i. 66.

47. **Valsa ciliatula**, Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1379; *Calosphæria Wahlenbergii*, Ntke. Pyr. 92 (?).

Sporidia .009–.012 × .002 mm. On bark of *Betula*. Bethlehem (Schw.). Sporidia described from specimen published by Fries. Scler. Suec. 147.

B. Sporidia allantoid (Major).

48. **Valsa quaternata**, Fr. S. V. S. 412; Schw. Am. Bor. 1386; Cooke Hdbk. 2482; *Quaternaria Persoonii*, Ntke. Pyr. 87.

Sporidia .014–.02 × .004 mm. On *Populus* and *Alnus serru-*

lata. Penna. (Mich.), Vermont (Russell), Carolina (Curt.), Ohio (Lea), New York (Gerard, 29, Peck).

49. **Valsa salicina**, Fr. S. V. S. 412; Schw. Am. Bor. 1361; Ntke. Pyr. 212; Cooke Hdbk. 2476.

Sporidia .014–.018 × .003 mm. On willow. Carolina (Curt.). New England (Russell), Penna. (Schw.), New York (Peck, 231). *Ravenel Fun. Car.* iv. 60.

50. **Valsa ambiens**, Fr. S. V. S. 412; Schw. Am. Bor. 1364; Ntke. Pyr. 213; Cooke Hdbk. 2475.

Sporidia .016–.022 × .005 mm. On apple, *Prunus*, etc., Penna. (Schw.), New York (Sartwell, Peck), Carolina (Schw. Curt.).

51. **Valsa coaperta**, Cooke in Grevillea, v.

Sporidia .016–.018 × .004 mm. On *Ulmus*. New York (Rav. 1903).

52. **Valsa dissepta**, Fr. S. V. S. 412; Schw. Am. Bor. 1347; Cooke Hdbk. 2467; *Quaternaria dissepta*, Ntke. Pyr. 88.

Sporidia pale brown, .024–.03 × .006–.008 mm. On *Salix* and *Amorpha fruticosa*. Carolina (Curl. Rav.). We have seen no American specimens; all the specimens, including Rav. 1219, belong to quite a different species. The fructification above given is from British specimens.

53. **Valsa mesoleuca**, B. & C. in Grevillea No. 879.

Sporidia .02 mm. long. On *Viburnum dentatum*. Penna. (Mich.). Disk white, surrounded by the black osteola, or sometimes dotted.

54. **Valsa dolosa**, Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1368; Ntke. Pyr. 200.

Sporidia .014–.018 × .003–.005 mm. On branches of *Celastrus*. Carolina (Schw.). The dimensions above are given from Nitschke. Notaris states that the sporidia are uniseptate.

55. **Valsa corniculata**, Ehr. Crypt. No. 300; Curtis Cat. p. 142; Schw. Am. Bor. 1325; Cooke Hdbk. 2438.

Sporidia .02 mm. long. On bark of ash. Carolina (Curt. Schw.).

56. **Valsa acclinis**, Fr. S. V. S. 412; Schw. Am. Bor. 1389.

Sporidia clustered together in a subglobose mass at the top of the ascus; .025–.02 mm. long. On branches of sassafras. Carolina (Schw. Curt.). Nitschke (Pyr. 207) gives the measurement of the sporidia as .007–.009 × .002 mm., which must be quite a different species.

C. Sporidia cylindrical.

57. **Valsa suffusa**, Fr. S. V. S. 412; Schw. Am. Bor. 1357; Cooke Hdbk. 2485.

Sporidia .04–.05 × .004 mm. On *Alnus* and *Salix*. New Jersey (M. J. B.); Bethlehem (Schw.); New York (Peck, 34). American specimens accord with British in the dimensions of the sporidia.

58. **Valsa trichispora**, C. & Pk. in N. Y. Museum Reports.

Sporidia very slender, almost filiform, .05 mm. long, faintly multiseptate. On oak twigs. New York (Peck, 7).

59. **Valsa albofusca**, C. & Ellis in Grevillea, vol. v. p. 31, pl. 75, fig. 8.

Sporidia linear, nucleate, .04 × .005 mm. On *Quercus obtusiloba*. New Jersey (Ellis, 2325). Measurements from the original specimen.

60. **Valsa cinctula**, C. & Pk. Grevillea, v. p. 31, pl. 75, fig. 15.

Sporidia linear, curved, triseptate when mature; .05 mm. long. On chestnut. New York (Peck, 272); New Jersey (Ellis, 2326). The clusters of perithecia are girt by a white ring. The sporidia in the original specimens from New York were simple, those from New Jersey faintly triseptate; apparently a question of maturity.

D. Sporidia fusiform.

61. **Valsa aculeatus**, Schw. Am. Bor. 1399. (*Valsa rufescens*, Schw. Am. Bor. 1395).

Sporidia fusiform, narrow, quadrinucleate, then triseptate; .015–.017 mm. long. On *Rhus typhina*. Massachusetts (M. J. B.); Carolina (Rav.). In our copy of Ravenel's Fungi, Car. fasc. iii. No. 68, under the name of *Valsa stilbostoma*, is this species. Dr. Curtis also seems to have fallen into this error.

62. **Valsa albovelata**, B. & C. in Grevillea No. 875.

Sporidia fusiform, narrow, quadrinucleate; .02 × .004 mm. On *Rhus copallina*. Carolina (Curt. Rav. 527). Disk white, pierced by the cylindrical ostiola. *Valsa polystoma*, B. & C. in herb. On *Rhus copallina*. According to specimen from Dr. Curtis, this must be the same species.

E. Sporidia subelliptical.

63. **Valsa innata**, B. & C. in Grevillea No. 874.

Sporidia oblong, uniseriate, narrowed towards each end; .0075 mm. long. On *Castanea vesca*. New York (Berk.). We have seen no specimen.

F. Sporidia uniseptate.

a. Not appendiculate.

64. **Valsa albocincta**, C. & Pk. in N. Y. Museum Reports.

Sporidia elliptic, uniseptate, slightly constricted, uniseriate; .018 × .006 mm. On *Acer spicatum*. New York (Peck). When the bark is removed, the perithecia are encircled with white, a black circumscribing line enters deeply into the wood.

65. **Valsa fibrosa**, Fr. S. V. S. p. 412; Schw. Am. Bor. 1324; Cooke Hdbk. 2489.

Sporidia elliptic, uniseptate; .015 × .007 mm. On branches. New York (Berk.), Carolina (Curt.). We have seen no American specimens. Rev. M. J. Berkeley states that the sporidia are uniseptate, at length fenestrate; .015 mm. long. European specimens do not exhibit any tendency to become fenestrate, and if this should prove a feature in the United States species, there is good ground for believing it distinct. Some authors unite *Valsa extensa* with this species.

66. **Valsa extensa**, Fr. S. V. S. 412; Schw. Am. Bor. 1315; Cooke Hdbk. 2488.

Sporidia elliptic, uniseriate; .013–.015 mm. long. On branches. Bethlehem (Schw.). Very closely allied to *Valsa fibrosa*, Fr.

67. **Valsa enteroleuca**, Fr. S. V. S. p. 412; Schw. Am. Bor. 1314; Cooke Hdbk. 2501.

Sporidia shortly fusiform, uniseptate; .015–.017 mm. long. On *Robinia*. Carolina (Curt.).

68. **Valsa leiphemia**, Fr. S. V. S. 412; Schw. Am. Bor. 1356; Cooke Hdbk. 2490.

Sporidia shortly fusiform, uniseptate; .015.–017 × .006 mm. On oak. South Carolina (Rav.); Penna. (Mich.) Sporidia described from British specimens.

69. **Valsa impulsa**, C. & Pk. in N. Y. Museum Reports.

Sporidia narrowly elliptic, uniseptate, nucleate; .02–.022 × .008 mm. On *Pyrus Americana*. New York (Peck, 273).

70. **Valsa glyptica**, B. & Curr. Grevillea No. 866.

Sporidia fusiform, sometimes sigmoid, uniseptate; .05 mm. long. On willow. Carolina (M. J. B.). We have not seen this species, but it reminds one so strongly of *Valsa tessera*, Fr., that we doubt whether the slight appendages may not have been overlooked.

71. **Valsa carpini**, Pers. Fr. S. V. S. 412; Schw. Am. Bor. 1326.

Sporidia lanceolate, uniseptate, nucleate; .014 × .004 mm. On *Carpinus betulus*. Carolina (Schw.); Penna. (Schw.).

72. **Valsa furfuracea**, Fr. S. V. S. 412; Schw. Am. Bor. 1387; Cooke Hdbk. 2493.

Sporidia uniseriate, narrowly elliptical, uniseptate, .025–03×.011 mm. On *Tilia*. Bethlehem (Schw.). Sporidia from British specimens referred to this species.

73. **Valsa conjuncta**, Nees Sys. p. 305; Fr. S. V. S. 412; Schw. Am. Bor. 1383

Sporidia lanceolate, uniseptate, .016 × .004 mm. On *Prunus*. Bethlehem (Schw.). Sporidia described from European specimens.

ß. Sporidia appendiculate.

74. **Valsa tessera**, Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1367 (*Valsa mucronata*, Peck).

Sporidia fusiform, straight or curved, uniseptate, .05–.06 × .011–.013 mm., with a short hyaline apiculus at each extremity. On bark of *Corylus* and *Salix*. Bethlehem (Schw.). New York (Peck).

75. **Valsa thelebola**, Fr. S. V. S. 412; Schw. Am. Bor. 1384; Cooke Hdbk. 2503.

Sporidia elongated, rounded at the ends, often curved, uniseptate, aristate at each extremity, .04–.045 × .01 mm., without the appendages. On *Juniperus Virginiana* and *Alnus*. Bethlehem (Schw.). N. York (Peck, 52). The New York specimens accord with the European.

76. **Valsa taleola**, Fr. S. V. S. 411; Schw. Am. Bor. 1345: Cooke Hdbk. 2502 (*Valsa oxyspora*, Peck).

Sporidia elliptical, uniseptate, .02–.03 mm. long, aristate at either end, and sometimes at the commissure at each side. On oak limbs. Carolina (Curt.). New York (Peck).

G. Sporidia multiseptate.

77. **Valsa gemmata**, B. & C. in Grevillea No. 876.

Sporidia fusiform, triseptate. On *Rhus radicans*. Carolina (Curt.). Ostiola stellate, necks united. Our specimen under this name (Rav. 1222) has very different fruit, and is similar to *Valsa tetraploa*.

78. **Valsa pennsylvanica**, B. & C. in Grevillea 865.

Sporidia narrow, oblong, sometimes wide at one end, sometimes slightly curved, triseptate, .025 mm. long. On *Cerasus Pennsylvanica*. New York (Berk.). Bursting transversely, perithecia in the centre of a facette. We have seen no specimen.

79. **Valsa capsularis**, Pers. Syn. p. 42; Curt. Cat. p. 142; Schw. Am. Bor. 1363.

Sporidia fusiform, triseptate, hyaline. On bark of *Ampelopsis*.

Carolina (Curt.). The characters of the fruit are given on the authority of Notaris.

Sect. II. Sporidia colored.

A. Sporidia simple.

80. Valsa turgida, Fr. S. V. S. p. 413; Curt. Cat. p. 142; Schw. Am. Bor. 1359. Cooke Hdbk. 2504.

Sporidia elliptic, brown, .0076–.01 mm. long. On *Liriodendron*. Carolina (Curt.). Penna. (Schw.). Described from European specimens.

B. Sporidia uniseptate.

81. Valsa texicl, Schw. Am. Bor. 1330.

Sporidia elliptical, uniseptate, brown, .012 × .005 mm. On *Rhus radicans*. S. Carolina (Rav. 1424).

82. Valsa celtidis, Cooke in Grevillea, v. p. 55, pl. 81, fig. 3.

Sporidia uniseriate, elliptic, uniseptate, brown, .02 × .008 mm. On branches of *Celtis*. S. Carolina (Rav. 1833). Quite distinct from *Sphæria celtidis* B. & C., according to the description.

83. Valsa notarisii, D. R. & M. Fl. Alg. t. 25, fig. 6.

Sporidia uniseriate, uniseptate, brown, constricted at the septum, .02 × .008 mm. On *Robinia* and *Gleditschia*. Carolina (Curt.).

83 *bis*. Valsa clethræcola, C. & E. Grevillea v. p. 92.

Sporidia biglobose, brown, uniseptate, .018 × .009 mm. On *Clethra alnifolia*. New Jersey (Ellis).

84. Valsa peckii, Howe MSS. in N Y. Museum Reports.

Sporidia uniserrate, uniseptate, brown, .014 × .006 mm. On *Kalmia*. New York (Howe). N. Jersey (Ellis).

85. Valsa fulvopruinata, Berk. in Lea's Cincinnati; Curr. Linn. Trans.

Sporidia elliptic, uniseptate, brown. On *Platanus*. Ohio (Lea), Carolina (Curtis), Conn. (Wright).

86. Valsa melastroma, Fr. S. V. S. p. 412; Schw. Am. Bor. 1358.

Sporidia elliptic, uniseptate, brown, .032 × .014 mm. On bark of *Ulmus*. Salem(Schw.). We have seen no authentic American specimen. Character of sporidia given from specimen published by Fries Scler. Suec. 223.

C. Sporidia multiseptate.

87. Valsa tubulosa, B. & C. in Grevillea.

Sporidia fusiform, obtuse at the ends, triseptate, brown, .03 × .01 mm. On *Alnus*. Carolina (Curtis). Sporidia from original specimen from Dr. Curtis.

88. Valsa profusa, Fr. S. V. S. p. 411 (*Valsa Sartwelli*, B. & C. in herb. *Aglaospora profusa*, Tul. Carp.); *Sphæria profusa*, Schw. Am. Bor. 1346; Cooke Hdbk. 2511.

Sporidia large, oblong, elliptic, quadrilocular, at length brown, .06–.07 × .018–.02 mm. On bark of *Robinia*. Carolina (Curt.), New England (Sprague), New York (Gerard, 9 Peck.). Authentic specimens of *V. Sartwelli* are undoubtedly this species.

89. Valsa convergens, Tode Fr. Sys. Myc.; Sch. Am. Bor. 1390; Cooke Hdbk. 2505.

Sporidia sub-cymbœform, irregular, triseptate, brown. On *Rosa corymbosa*. Carolina (Schw.), Penna. (Schw.).

β. Sporidia appendiculate.

90. Valsa hapalocystis, B. & Br.; Cooke Hdbk. No. 2515.

Sporidia oblong-elliptic, appendiculate at either end, biseptate, brown, .035 × .015 mm. On *Platanus occidentalis*. New York (Peck). Inserted on the authority of Mr. Peck.

γ. Sporidia transversely septate.

91. Valsa condensata, B. & C. Grevillea, No. 878.

Sporidia obovate, 5 septate, here and there vertically divided, brown, .02 mm. long. On *Quercus montana*. Virginia (Curt.).

92. Valsa castanicola, B. & C. in Grevillea, No. 869.

Sporidia cymbœform, pointed, triseptate, at length vertically divided, .01 mm. long. On small twigs of *Castanea*. Virginia (Curt.). We have not seen this species. Probably it is the same with *Valsa castanophila* of Curtis's catalogue.

93. Valsa vestita, Fr. S. V. S. p. 412; Schw. Am. Bor. 1388; Cooke Hdbk. 2514.

Sporidia elliptic, brown, transversely and longitudinally septate, .02 mm. long. On *Ribes florida*. Bethlehem (Schw.). Described from European specimens.

Sporidia uncertain.

94. Valsa plagia, B. & C. Curt. Cat. p. 141.

Fallen limbs of *Liriodendron*. Carolina (Curt.). This species does not appear to be known to the Rev. M. J. Berkeley.

95. **Valsa Bignoniæ**, Schw. Am. Bor. 1310; Curt. Cat. p. 141.

On bark of *Tecoma*. Carolina (Curt. Schw.).

96. **Valsa scoparia**, Schw. Am. Bor. 1318; Curt. Cat. p. 141.

On bark of *Juglans*. Carolina (Curt.).

97. **Valsa pugillus**, Schw. Am. Bor. 1322; Curt. Cat. p. 142.

On wood of maple. Carolina (Curt.). Penna. (Schw.).

98. **Valsa scutellata**, Pers. Syn. Fung. 37; Curt. Cat. p. 142; Schw. Am. Bor. 1344.

On *Prunus* and *Cornus*. Carolina (Schw.). Penna. (Schw.

99. **Valsa frustrum-coni**, Schw. Am. Bor. 1329; Curt. Cat. p. 142.

On roots of oak. Carolina (Curt.).

100. **Valsa ciliata**, Fr. S. V. S. p. 141; Curt. Cat. p. 142; Schw. Bor. 1349. (*Vide* Tul. Carp. ii. pp. 201.)

On bark of *Ulmus*. Penna. (Schw.). Carolina (Curt.).

101. **Valsa pusio**, B. & C. in herb.; Curt. Cat. p. 142.

On braches of *Morus multicaulis*. Carolina (Curt.). This species does not appear to be known to the Rev. M. J. Berkeley.

102. **Valsa umbilicata**, Pers. in Fr. S. V. S. p. 412; Curt. Cat. p. 142; Schw. Am. Bor. 1385.

On branches of *Lonicera sempervirens*. Carolina (Curt.). Bethlehem (Schw.).

103. **Valsa divergens**, Schw. Am. Bor. 1393; Curt. Cat. p. 143.

On *Liquidambar*. Carolina (Schw. Curt.).

104. **Valsa juglandicola**, Schw. Am. Bor. 1328.

On *Juglans tomentosa* and *alba*. Carolina (Schw.). Penna. (Schw.).

105. **Valsa rubincola**, Schw. Am. Bor. 1329.

On *Rubus*. Bethlehem (Schw.).

106. **Valsa allostoma**, Schw. Am. Bor. 1332.

On Robinia. New England (Torrey).

107. **Valsa oligostoma**, Schw. Am. Bor. 1333.

Inside bark of *Castanea*. Bethlehem (Schw.).

108. **Valsa amorphostoma**, Schw. Am. Bor. 1334.

On *Gleditschia*. Bethlehem (Schw.).

109. **Valsa radicium**, Schw. Am. Bor. 1335.

On roots of trees. Bethlehem (Schw.).

110. **Valsa conspurcata**, Schw. Am. Bor. 1336.

On oak branches. Bethlehem (Schw.).

111. **Valsa modesta**, Schw. Am. Bor. 1337.

On young branches of *Ulmus*. Bethlehem (Schw.).

112. **Valsa comptoniæ**, Schw. Am. Bor. 1353.

On *Comptonia*. Bethlehem (Schw.).

113. **Valsa variolaria**, Schw. Am. Bor. 1371.

On *Tilia*. Bethlehem (Schw.).

114. **Valsa conseptata**, Schw. Am. Bor. 1373.

On bark of *Gleditschia*. Bethlehem (Schw.).

115. **Valsa papyriferæ**, Schw. Am. Bor. 1375.

On *Broussonetia papyrifera*. Bethlehem (Schw.).

116. **Valsa ceanothi**, Schw. Am. Bor. 1376.

On dead stems of *Ceanothus*. Bethlehem (Schw.).

117. **Valsa indistincta**, Schw. Am. Bor. 1377.

On young branches of sassafras. Carolina (Schw.).

118. **Valsa quadrifida**, Schw. Am. Bor. 1378.

On *Vaccinium corymbosum*. Bethlehem (Schw.).

119. **Valsa scabriseta**, Schw. Am. Bor. 1394.

On other *Sphœria* on bark of *Castanea*. Bethlehem (Schw.).

120. **Valsa expers**, Schw. Am. Bor. 1396.

On *Rosa corymbosa*. Bethlehem (Schw.).

121. **Valsa rimicola**, Schw. Am. Bor. 1397.

On *Comptonia asplenifolia*. Bethlehem (Schw.).

122. **Valsa rhizina**, Schw. Am. Bor. 1398.

On roots of *Rhododendron*. Bethlehem (Schw.).

123. **Valsa halseyana**, Schw. Am. Bor. 1319.

On bark of *Betula*. New York (Schw.).

124. **Valsa lixivia**, Fr. S. V. S. p. 411; Schw. Am. Bor. 1327.

On *Juglans cinerea*. Bethlehem (Schw.).

125. **Valsa tortuosa**, Fr. Act. Holm. 1817, p. 98; Schw. Am. Bor. 1350.

On pine branches, infested with *Peridermium*. New Jersey (Schw.).

126. **Valsa deformis**, Fr. Sys. Myc. ii. 398; Schw. Am. Bor. 1355.

On *Quercus*. Bethlehem (Schw.).

...ma, Fr. S. V. S. p. 142; Schw. Am. Bor. 1360.

...wigs. Bethlehem (Schw.).

...alsa leucopis, Fr. S. V. S. p. 412; Schw. Am. Bor. 1365.

On *Syringa*. Bethlehem (Schw.).

29. **Valsa sphinctrina**, Fr. S. V. S. p. 412; Schw. Am. Bor.

On *Catalpa* and *Juglans nigra*. Bethlehem (Schw.).

Valsa aperta, Fries (?); Schw. Am. Bor. 1381.

On *Populus italica*. Bethlehem (Schw.).

Valsa vasculosa, Fr. S. V. S. p. 412; Schw. Am. Bor. 1382.

On *Prunus*. Bethlehem (Schw.).

...pusilla, Fr. S. V. S. p. 412; Schw. Am. Bor. 1391.

On bark of *Castanea*. Bethlehem (Schw.).

Valsa abnormis, Fr. S. V. S. p. 412; Schw. Am. Bor. 1392.

On *Sambucus*. Fries writes of this "*V. abnormis*, dubia sp." have seen no specimen.

MELANCONIS, Tul. Carp. ii. 115.

A. Sporidia colored.

1. **Melanconis stilbostoma**, Tul. Carp. ii. 120; Schw. Am. Bor. 1366; Cooke Hdbk. 2454.

Conidia subglobose, olive, .014–.016 × .008–.01 mm. Stylospores elliptic, uniseptate, brown. Sporidia biseriate, colorless, uniseptate. .018 × .008 mm. On bark of *Betula*, *Acer*, *Melia*. Carolina (Schw. Rav.), Penn. (Schw.), New York (Peck 15). In the New York specimens stylospores, like the spores of *Diplodia*, occur in perithecia, which are collected in circles, and so much like those containing ascospores, that the one cannot be distinguished from the other by any external feature. Hitherto we have not seen such stylospores associated with European specimens, nevertheless there is no reason for supposing that the American species is distinct. The size and character of the ascospores are precisely identical. This is an interesting contribution to the life history of the species for which we are indebted to Mr. C. Peck, on *Betula papyrifera*.

2. **Melanconis chrysostoma**, (Fr.), Tul. Fung. Carp. ii. p. 125; Cooke Hdbk. 2456 (not Fuckel).

Conidia ovate, apiculate at the base; olive brown; 1–2 nucleate,

015 × .01 mm. Sporidia elliptic, uniseptate, hyaline, .0177–022 mm. long. On bark of *Carpinus*, *Quercus alba*. Carolina (Peck).

B. Sporidia colored.

a. Not appendiculate.

3. **Melanconis lanciformis**, Tul. Carp. ii. t. 16; Schw. Am. Bor. 1263; Cooke Hdbk. 2458.

Conidia clavate, 3- 4- 6-celled. Sporidia long, elliptical, brown, quinqueseptate, .036 × .012 mm. On *Betula*. Bethlehem (Schw.).

Melanconis elliptica, Peck, on *Betula populifolia*; does not appear to be specifically distinct from *M. lanciformis*.

b. Sporidia appendiculate.

4. **Melanconis bicornis**, C. & Pk. in N. Y. Museum Reports.

Sporidia .06 × .015 mm. with appendages, together .15 mm. long. On *Platanus*. New York (Peck, Gerard).

5. **Melanconis amygdalina**, Cooke in Grevillea, v. p. 55, pl. 81, fig. 4.

Sporidia almond-shaped, simple brown, .025 × .01 mm. with thin hyaline appendages at each end, .02–.03 mm. long. On *Liquidambar*. Carolina (Rav.).

MARCH 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-eight members present.

Influence of Nutrition on Fertilization.—Mr. THOMAS MEEHAN said that considerable interest had been manifested in England in the unusual failure of the Holly to produce berries, and Mr. Darwin had written a letter to say that bees were everywhere rare in the localities examined by him last spring, and suggesting that this scarcity had resulted in non-pollenization through lack of insect aid. Mr. Meehan was surprised at the suggestion, as the Holly was classed with the anemophilous (wind loving) plants, which were not considered, even by Mr. Darwin's friends, as requiring this assistance. With all respect, however, for the immense services which Mr. Darwin and his close followers had rendered to science, he felt quite sure that they frequently mistook the work of ordinary laws of nutrition for the effects of pollenization; and of this he would now offer an illustration in the case of the common mignonette. In the open air with us this plant seeded freely; in close greenhouses in winter forcing very rarely. Until this year he had never had plants to produce seeds in winter. Others had found a similar experience, and it was common to hear the remark "behold the results of insect agency! In the open air insects visit them, and you get seeds—in the winter greenhouse there are no insects and no seed." But as if to protest against this conclusion, his plants, of which he distributed specimens, had taken to producing seed in abundance; that is to say, every flower had seed. There were from two to six perfect ones in each capsule, not so much as in the open air; but still all had some seed. As regards insects, the conditions this winter were precisely the same as heretofore. They had nothing to do with it. There may have been more light or less light, more heat or less heat, or the earth in which they are growing may not have been exactly the same; or there may have been some other circumstances which gave nutrition a better chance to work on the reproductive organs than heretofore; at any rate insect aid is out of the question in cases like these. He had shown before that so far as the clover was concerned in this country, it would produce seed freely without insect aid; and in explanation of this it had been urged that the doctrine in relation to this question did not preclude the plants in many cases fertilizing themselves when insect aid could not be obtained, and quotations from Mr. Darwin's works had been made before the Academy and elsewhere in support of this view. But in this very letter on the Holly, Mr. Darwin must have forgotten if he ever held to this accommodating view, as he reiterates the

statement that clover seed is a failure when the flowers are not visited by bees.

The Bluebird and Holly berries.—Mr. THOMAS MEEHAN observed that the Blue bird had this season stripped his Holly trees of their berries, though it had been supposed by all, he believed, that no birds ate them. Some of the trees were but a few feet from his library window, which gave him a good opportunity to note that it was this and not the Snow-bird. These birds remained with him all through the severe weather of December, not leaving till the January snows came. They fed also on the berries of the common red cedar. He believed in the case of this bird the migration south in the winter season was not with them a question of temperature, but one of food. At least they remained with him in his cedar woods till the berries were all gone.

Vitality of Seeds under Low Temperature.—Mr. THOMAS MEEHAN referred to the seeds of wheat, oats and Indian corn, which, after having been left by the Polaris in 1872, had been found in 1876 by the Nares exploring expedition, and which, though exposed to the severity of four arctic winters, had yet grown. The growing plants had recently been exhibited before an English scientific society, and surprise expressed, particularly that seed of the maize, a tropical plant, should have received no injury. Mr. Meehan said that though the facts may not have been placed on record, it was not unknown in America that seeds of tropical plants had a power of resisting low temperatures not possessed by the plants themselves. The common forms of *Ipomæa*, known as "morning glories," the "Balsams" (*Impatiens*), the common tomato, and others, came up in gardens from self-sown seeds; and indeed there were large numbers of tropical weeds, which the first frosts destroy, and yet the seedlings appear the next year in great numbers. He called attention to this arctic experience with seeds, however, chiefly to suggest what had often occurred to him, from such observations, that seeds may keep for an indefinite time in low temperatures, when under high ones they soon lose vitality. There is no reason that he knew of why seeds might not get into an iceberg—keeping fresh perhaps for centuries—and in this way some problems in the geographical distribution of plants be solved. He suggested trials by those who had the opportunity. The common silver maple (*Acer dasycarpum*) had seed which usually completely lost vitality in a couple of months from maturity. Experiments with these by those who had large ice-houses, could not fail of resulting in useful knowledge.

On Rocky Mountain Locusts.—Dr. LE CONTE exhibited some recently hatched Rocky Mountain locusts, commonly called grasshoppers, which had just been sent to him by Professor Henry, of the Smithsonian Institution, and read the following communica-

tion, including extracts from the letter which accompanied them, giving the statement of Mr. J. N. High, by whom the eggs were collected near Fort Kearney, Nebraska:—

"They are found in small cylindrical tubes about one-tenth of an inch in diameter and four or five inches below the surface. Freezing does not destroy the eggs, nor the young 'hopper. It is said they may be frozen solid in water, and when the ice is thawed they will still exhibit life. They are said always to move in one direction, eastward, and that the tendency of the young is instinctively to hop in that direction. When the wind is unfavorable, or from an easterly direction, they alight and remain on the ground until the wind changes."

While these remarks are perhaps founded upon too limited observation, they at all events enable the members of the Academy to make the personal acquaintance of this formidable pest, and to hear a brief synopsis of the plans devised for its suppresion.

It will of course be impossible within the few minutes available at this meeting to condense the voluminous literature on the Locust in this and other countries, but there are a few points to which I may call your attention with profit.

The injury inflicted by these insects had extended over so large a space and so long a time, that towards the end of October (25th and 26th), a conference of Governors of Missouri, Iowa, Kansas, Nebraska, Minnesota, and Dakotah was held at Omaha. In this meeting they were assisted by the counsel of several eminent men of science, among whom were the State Entomologists of Missouri and Illinois, Professors Riley and Thomas.

Various methods of destroying the locust were suggested, in accordance with the experience gained in other countries, and from the study of other insects. But the efficacy of all these methods was clearly shown to depend upon principles not dissimilar to some of the propositions set forth by me in an address delivered at Portland, in August, 1873, and another at Detroit, in August, 1875, and these principles may be summed up as follows, and are applicable to all insect pests:—

First. Correct observations in regard to the history and habits of the noxious insect, including its range of distribution; the time of its appearance in its different stages of development; in various parts of its area of distribution, its habits in these different stages; so that the proper time for most efficient attack may be found.

Second. Careful study of the most effective means of destruction, whether by means of mechanical (rolling, crushing, etc.), chemical (poisons, etc.), purely industrial (human labor), or vital (encouragement of birds and other enemies of the noxious insect).

Third. The publication in a popular form of this calendar of growth and habits of each species, and the effect of the various modes of suppression which are found efficacious, and the distri-

bution to farmers within the infested district of this compendium of useful knowledge.

Fourth. The procuring by wise legislation enactments of combined effort on the part of the agriculturists of the afflicted region, under the directions contained in the publication suggested in section 3, based upon the careful observations required by sections 1 and 2. Such information as is required for this purpose cannot be obtained without the aid of the National Government, as I have said on former occasions; and the whole spirit of the record of the proceedings of the conference of Governors, which I have mentioned above, is that the Government should take hold of this subject with the earnestness which its importance demands. Many similar appeals had been made before, but never by so distinguished a body, representing the will of five populous States and one Territory, all of which had been greatly devastated by this single insect, and in which the channels of human immigration had been changed by its ravages.

Yet this application failed as all former ones had done; and to this day there is not in the possession of any farmer or any student of science the information necessary for the suppression of even a single insect pest, unless it has been laboriously acquired by sifting many volumes of difficult access or of large cost.

On Mineral Caoutchouc.—Mr. GALLOWAY C. MORRIS presented specimens of mineral caoutchouc from South Australia, and stated that the material had attracted his attention in the exhibit of the South Australian Department of the Centennial Exhibition. From the exhibitor, Mr. C. W. Stuart, he had obtained the specimens, and from him learned that the substance is found during the dry season in a small section of country of a swampy nature in the Coorong District. It occurs in sheets from the thickness of a sheet of paper to about five-eighths of an inch; and is being manufactured into a good article of illuminating oil.

The geological formation of the basin in which it is found is thus described:—The surface is sand, either white and barren or brown and loamy, with occasional ridges or distributions of limestone. Below that is segregated limestone, hard and approaching crystallization, the interstices filled with light brown tenacious clay, followed by compact light red sandstone of various thickness gradually fading in color and consistence until it touches the water and merges into quicksand. On the lowest flats, fissures occur in the limestone; the orifices are very small and irregular but reach to the underlying quicksand.

In connection with this mineral caoutchouc is found another material, a sample of which he also presented which goes under the local name, from the district in which it is found, of Coorongite. He was told that it is found over the same ground as the caoutchouc, but at a rather lower level. He had found this mate-

rial to consist principally of fresh-water Diatomaceæ cemented together with some hydrocarbon.

An analysis of the caoutchouc had been forwarded to him, which was as follows:—

Moisture	0.4682
Carbon	64.7300
Hydrogen	11.6300
Ash	1.7900
Fixed carbon	1.0050
Oxygen and other unestimated matters	20.3768
	100.0000

March 13.

The President, Dr. Ruschenberger, in the chair.

Thirty-two members present.

Papers entitled "Notes on Genera Acidaspis, Murchison, Odontopleura, Emmrich, and Ceratocephala, Warder," by A. W. Vogdes, and "Chemical Notes," by Geo. Hay, were presented for publication.

The death of Frank W. Lankenau was announced.

Evolutionary Law as illustrated by Abnormal Growth in an Apple Tree.—Mr. Thomas Meehan exhibited some branches of a "Smoke-house" apple tree, which had the cluster of flowers at the end of a young shoot, flowering after the leaves and growth had matured, instead of blooming in spurs early in spring, and simultaneously with the expansion of the leaves, as in ordinary cases. There were numerous instances of the normal and abnormal growths on the same tree, the abnormal ones flowering about six weeks after the normal ones, but both classes maturing the fruit at about the same time in the fall. He explained that physiologically there was but a slight difference between what was known in the botanies as plants which bloom from last season's wood, and plants which flower from the growth of the same year. In the case of the former the spirals are closely appressed, as could be seen by examining the old apple spurs exhibited. The scars where the leaves or their equivalent bud scales had existed were so close together that there were scarcely any internodes. In the case of that class which flower from the growth of the same year, it was simply that the spirals closely appressed in the spurs were now drawn out. In these apple branches there were from six to nine internodes before the clusters of flowers were borne.

The point he wished particularly to draw attention to was that when there was a change in one important character, there was often change in others making a complete set of characters which

need nothing but permanence to be regarded as specific. For instance, the fruit from these terminal clusters was as unlike the normal "Smoke-house" as it was possible to be. The fruit stems were very long and slender, and the fruit flattened—what pomologists term oblate. It might further be noted that this change was not a change by gradual modification through seminal agency; but a leap, and from a tree that had always produced flowers in the normal way. There was apparently no more reason why the law, whatever it may be, that operated on this one tree might not under some circumstance operate on all the trees in the orchard, or on other wild trees in native places of growth, or on the individuals of a whole district, as well as on a single tree. If trees with such a set of differences were found in a wild condition and their parentage not known, a botanist would undoubtedly regard them as constituting very distinct species, and describe and name them accordingly. It was such illustrations as these which made the doctrine of evolution in some form an absolute certainty.

MARCH 20.

Mr. VAUX, Vice-President, in the chair.

Thirty-four members present.

MARCH 27.

Mr. VAUX, Vice-President, in the chair.

Twenty members present.

A paper entitled "On Elaterite and Coorongite from New South Wales, Australia," by E. Goldsmith, was presented for publication.

Charles Ashburner and Thomas Mackellar were elected members.

P. A. Von Kotschubey, of St. Petersburg, was elected a correspondent.

The following papers were ordered to be printed:—

ON THE VITAL POWERS OF ANTS.

BY REV. H. C. McCOOK.

It is well known, that insects generally are highly endowed with vital powers for the maintenance of existence and the perpetuation of their species. The following facts may illustrate the ability of the Formicidæ to maintain life under most unfavorable conditions:—

1. *The Survival of Ants under Exposure to severe Cold.*—A portion of a formicary of *Formica Pennsylvanica*,[1] the Pennsylvania carpenter ant, was cut during the month of January last, from an oak bough on Brush Mountain, Blair Co., Pa. It was preserved by the wood-choppers and sent to me by Mr. Jas. W. Riddle, of Bell's Mills. The ants, as usual during winter, were torpid. A few of them were put in a bottle; the others remaining in the nest were placed out of doors, where they remained for two weeks exposed to the rigor of a mountain winter. When the formicary reached Philadelphia, it was placed in the cellar of the Academy for several days. Upon removing the wrappings and sawing the block into sections, the ants were found to have become active. A great number, several hundred, with a few larvæ were stowed away within this small space. As it was necessary to free the formicary of its contents, all the ants were knocked out, and deposited in the yard, to give them some chance for their lives. A few happened to drop upon the ice, which lay several inches thick upon the ground. Forty-eight hours afterward I found these ants alive. They were imbedded in the ice within the small depressions made by their animal heat. They moved about as soon as removed and became quite active when placed in the closed hand. I have had the opinion that many of these ants were destroyed by our severe winters; but the above facts, viz., the preservation of the entire contents of the formicary, and the power to endure unharmed forty-eight hours freezing upon ice, seem to indicate that most of these insects survive the winter, and enter upon the spring in unbroken community. The ants preserved in the bottle had amongst them the wingless or fertile queen, and have been

[1] *Camponotus Pennsylvanicus*, according to Mr. Norton's recent classification.

kept in a glass jar under observation. They become torpid at night, but thaw out again in the heat of the room, and are very active, cutting galleries in wood, and constructing galleries from particles of paper and other litter cut into pellets.

In connection with this, I will barely allude to observations made on the 12th of February, 1877, upon the winter habits of the Fallow ant, *Formica rufa*. The ants were found in the hills at temperatures varying from 30° to 34° (Fahr.). At 30 degrees, in the frozen portion of the cone of the formicary, they were active but sluggish. In the centre of the hill at a temperature of 34°, they were found active and lively. It would thus seem that these interesting creatures are also proof against the rigors of our mountain frosts, and the prolonged season of fasting which winter compels.

2. *The Ability of Ants to endure extreme Heat.*—While encamped last summer upon Brush Mt., studying the habits of the Fallow ant, my attention was called to the following fact: There had been placed upon the camp-fire a portion of a decayed stump, one end of which touched the top of the wall of flat stones which our servant had erected on two sides of the hearth. A large flat stone was laid across the angle of these walls. The servant having occasion to remove this stone found the under surface thickly covered with black ants. I was called to the spot, and found that a community of Pennsylvania ants (*F. Pennsylvanica*) had been established within the stump, a fact of course unknown when it was placed upon the fire. One end of the stump touched the wall, over which the ants, driven by the heat, had passed, and lodged upon the under surface of the stone. I did not take the temperature of the stone, but it may well be conceived that it was quite hot. The ants had clustered on the side toward the fire, which filled the hearth. I rescued the individuals still within the log. When the stone was dropped, the others straightway began to scamper off into the grass evidently unhurt, and not even inconvenienced by their severe baking.[1]

Mr. E. T. Cresson recently placed in my hands a package of original MS. notes made by Dr. G. Lincecum upon the ants of Texas. I find in these a fact concerning the agricultural ant, *Myrmica molefaciens*, which shows something of the same sala-

[1] The incident is fully recorded in Proc. Am. Ent. Soc., Dec. 1876.

mander-like qualities upon the part of that insect. A community of agricultural ants was located near a blacksmith's shop, which had been in operation for five years. During all that period the smiths had built their fires for heating wagon tires, upon the pavement or flat mound of these ants. This occurred on an average as often as two or three times a week. Frequently as many as nine tires a day had been heated upon the mound. After five years of such experience, Dr. Lincecum records that he saw numbers of ants at work, cleaning out the entrance to their city, before the fire that had just been used for heating tires was entirely extinguished. They seemed to have learned all about fire, and knew how to work around and among the half extinguished coals without injury. At the expiration of the five years, the colony was not numerous, had perhaps suffered a decrease; but they had not been driven away, and showed every sign of strong determination still to "hold the fort."

3. *Ability to survive exposure under Water.*—Last summer (1876), I discovered near Marple, Delaware Co., Pa., a formicary of mason ants, apparently a variety of *F. rufa*, the Fallow ant. The nest was in the ground, the communication thereto being by a gallery opening directly upon the surface. I placed these ants for observation in an artificial formicarium which was insulated in a tub of water. One night the covering by which the formicarium was protected during bad weather was left off, or removed by some meddler. A heavy shower fell early in the evening. In the morning the formicary was flooded; the ants were dead. Dead and lying under five inches of water, mixed up with the mortar, which the rain had formed with the soil that composed the galleries. I poured out the water, and set the box in the sun with a forlorn hope that some of the ants might revive. At noon I chanced to open a paper box in which I had placed a dead female ant of the genus *Myrmica*, a jet black insect. It had fallen into the tub, where it had been floating for many hours apparently drowned. It was now crawling about the box alive. Thereupon I visited my dead Fallow ants, and found three of them moving about in the slush endeavoring to extricate themselves. Another was struggling out of the muddy sediment in the jar which formed the lower part of the formicary. In short, the greater part of the drowned ants proved themselves to be veritable Noachians and survived the flood.

I conclude, by giving another observation from the MS. notes of Mr. Lincecum. During protracted periods of dry weather the agricultural ant of Texas is frequently found in great numbers in the wells whither they had probably gone in pursuit of water. Being unused to such a novel position, they are unable to return, and fall into the water. Instead of succumbing individually to the threatened doom, they extemporize a most efficient life-raft by collecting and clinging together in floating masses as large as an orange. In this condition they are often drawn up in the bucket, and notwithstanding they may have been in the water a day or more, they are all found to be alive, although half drowned and barely able to move. According to Mr. Lincecum, this species of ant cannot survive longer than six minutes under water, so that the submerged portion of the globular mass must have perished within that period, if they are supposed to remain in the same relative position. Yet the ants are *all* alive! The ball must therefore have been caused to revolve in the water. Shall we account for this life-saving process by considering it simply an accident of the instinctive struggles of the insects to rise out of the water and reach and remain upon the surface of the mass; or, with the observer, shall we consider it the result of a united, properly directed and systematic motion of the disengaged limbs of the outer tier of ants occupying the submerged portion of the revolving mass? The former theory seems sufficient to explain the phenomenon, but the wonderful intelligence of hymenopterous insects makes the latter opinion at least quite plausible. In either case we have another example of the high endowments of the *Formicidæ* to maintain and perpetuate their race through the severest struggles for life.

NOTES ON THE GENERA ACIDASPIS, MURCHISON; ODONTOPLEURA, EMMERICH; AND CERATOCEPHALA, WARDER.

BY A. W. VOGDES.

The genus *Acidaspis* was established by Sir R. I. Murchison in his Silurian System, published 1839. In the same year Dr. Emmerich's De Trilobiten Dessert. inauguralis, appeared, with the generic classification *Odontopleura*, for the same genus; therefore great doubt has been expressed with regard to the priority of the two generic names; the German school have followed Dr. Emmerich's nomenclature, the British Palæontographical writers Murchison's generic name. The American geologists have generally given the generic name *Acidaspis* to species of this family, with the exception of Dr. Lock, who classed a species of this genus (*C. crosotus*) under Green's *Ceraurus*.

The special study of American trilobites has caused us to investigate the early works upon American palæontology, and we find this genus described by Dr. Warder (Am. Journ. Sci. and Arts, vol. xxxiv., No. 2, p. 377, 1838), under the generic name *Ceratocephala*.

His generic characters are very imperfect; he has not only inverted his description, but also his figure, mistaking the two divergent spines on the neck-furrow for antennæ. The generic characters point to the two surface granules, the divergent spines of the occipital furrow, the three pair of rounded lateral lobes which occupy the spaces between the glabella and cheeks; also to the connection of the eyes in front of the glabella by a strong ocular ridge. The figure indicates good generic characters.

Dr. Anthony, in the same journal, places a species under Dr. Warder's genus, with the error of mistaking a pygidium for the cephalic shield.

With regard to Dr. Warder's generic name, *Ceratocephala*, we advance the opinion that Dr. Warder has clearly established his genus, having given a description accompanied with a figure, and under the rule, his generic name, being the earliest, ought certainly to take precedence.

The objection may be made that the generic characters of *Ceratocephala* are obscure and somewhat inaccurate. To this

argument we would advance as positive evidence, that the accepted genus *Triarthrus*, Green, was established upon the errors of its author. Dr. Green mistook the glabella for the entire animal; and the genus *Ogygia*, Brongniart, was founded upon the typical species *Ogygia buchii*, which was classed and described by the author under his genus *Asaphus*. In fact, all the *Ogygia* described by Brongniart have been referred to the genus *Asaphus*, except *O. desmarestii*, the last species described.

Corda objects to Warder's genus under the 10th Rule (Rules for rectifying the present nomenclature of zoölogy, British Assoc. Adv. Sci., 1842) in consequence of its similarity to *Ceratocephalus*, De Candolle, Methodus, 1794.

These names, however, seem to be sufficiently distinct to prevent confusion; certainly they are as much so as many others retained in natural history—for instance, *Pica* and *Picus*, *Cyprina* and *Cyprinus*, etc.

The objection to *Ceratocephala* cannot be made under this rule, for De Candolle's genus has been cancelled in toto by Bentham and Hooker, who unhesitatingly refer it to the genus *Ranunculus*.

CERATOCEPHALA, Warder.

Western Acad. of Nat. Sci., Cincinnati, May 25, 1838.
Am. Journ. Sci. and Arts, vol. xxxiv., No. 2, p. 377, 1838, fig.
Not *Ceratocephalus*, De Candolle, 1794.
Odontopleura, Emmerich, 1839.
Acidaspis, Murchison, 1839.
Ceraurus crosotus, Lock, 1843.
Dicranurus, Conrad, 1841.
Trapelocera, Corda, 1847.

Generic Char.—Head short, broad, truncate in front; the glabella broadest at the base, with a median portion strongly separated from the three lateral lobes, which are obscurely divided from the cheeks; cheeks thickened, generally spinous at the margin, and the angle produced into spines; eyes smooth, convex, connected with the front of the glabella by a strong ocular ridge; neck segment much enlarged, and generally produced into spines; body of 9 or 10 segments (fewer during the metamorphosis), with a narrow convexed axis, and horizontal pleuræ which are produced at their ends into spines; pygidium small, axis abbreviated, limb

multidentate, with one strong lateral rib on each side produced beyond the margin (*fide* Salter, Decade vii. pl. vi.).

With our present knowledge we would follow the lead of a previous author, and subdivide the genus *Ceratocephala* into two groups, viz.:—

I. *Ceratocephala Trapelocera*, Corda, 1847; type *C. vesiculosa*, Beyrich.
II. " *Odontopleura*, Emmerich, 1839; type *C. ovata*, Emmerich.

American Species.

Acidaspis cincinnatiensis, Meek, 1873, Geol. Ohio, Pal. vol. i. 167, pl. 14 (fig. pygidium). Compare *O. crassatus*, Locke, *O. prouesti*, Barrande.

Ceratocephala cornigera, Anthony, 1838, Am. Journ. Sci., vol. xxxiv. figs. 1–2. Meek, Geol. Ohio, Pal. vol. i. p. 169, pl. xiv., figs. 8–9. Cincinnati.

Cheirurus crassatus, Locke, 1842, Am. Journ Sci., vol. xliv., wood-cut, p. 347. Meek, Geol. Ohio, vol. i. p. 165, pl. xiv. fig. 10 a–b. Cincinnati.

Ceratocephala geniata, Warder, 1838, Western Acad. Nat. Sci., Cincinnati, May 25, 1838. Am. Journ. Sci. and Arts. vol. xxxiv., No. 2, 1838. Niagara group.

Compare—

O. vesiculosus, Beyrich, 1846, Uber Trilobiten, pl. iii. fig. 7 a–b.
Danai, Hall, 1862, Geol., Wisconsin, vol. i. 469. No figure or description.

Acidaspis Ida, Winchell & Marcy, Mem. Boston Soc. Nat. Hist., vol. i. 106, pl. iii. fig. 13.

Hall, 20th Regents' Report, 333, pl. xxi., figs. 8–9. Niagara group, Bridgeport, Ill.

Prof. Hall refers (20th Regents' Report, p. 400) *Acidaspis Ida*, W. & M., to his species *A. Danai*, and says *A. Danai* differs from *A. vesiculosus*, Beyrich, "in being more transverse, in the narrower front of the glabella, and in the straight instead of curving ocular ridges."

C. Halli, Shumard, 1855, Geol. Missouri, 200, pl. A, fig. 7. Cape Girardeau.

C. Horanii, Billings, 1843–4, Geol. Survey Canada, 341. Trenton group, R. la Frepinne.

Dicranurus hamata, Conrad, 1841, Ann. Report Pal. N. Y., page 48.

C. hamata, Hall, Pal. N. Y. vol. iii. 37. Also 15th Regents' Rep., plate ii. fig. 1. Meek, Geol. Ill., vol. iii. 390.

Lower Helderberg group, Albany and Schoharie Counties.

Acantholoma spinosa, Conrad, 1841, Rep. 39.

A. tuberculatus, Hall, Pal. N. Y. vol. iii. 368. 15th Regents' Rep. pl. ii. fig. 3; Conrad, 1840, Ann. Report Pal. N. Y., 205.

This name was used by Kloden, for a species of this genus, *vid.* Verst. der Mark Brandenberg, 112.

Lower Helderberg group, Albany and Schoharie Counties, New York.

A. trentonensis? Hall, 1847, Pal. N. Y. pl. 64. Trenton group, Bay of Quinte, Lake Ontario.

A. speniger? Hall, 1847, Pal. N. Y., vol. i. pl. 64, fig. 5. Trenton group, Mohawk Valley.

ON THE NITRATES OF TIN, ANTIMONY, AND ARSENIC.

BY GEO. HAY, M.D.

Since the publication (May, 1876), in the Proceedings of the Academy of Natural Sciences of Philadelphia, of my paper on Tin, Antimony, and Arsenic, I have attempted to isolate and procure in the crystalline form the nitrates whose reactions were therein described, and now commit to the Academy the results of my investigations.

Prepared solution of protonitrate of tin as described in previous paper. Placed solution in porcelain cup over another cup containing concentrated sulphuric acid, and alongside of this placed several fragments of caustic soda on ground-glass plate, and covered the entire arrangement with a ground bell-jar with its edge greased. Exhausted the receiver of two-thirds of its air, and left the solution for several days to evaporate. It became a syrupy liquid, of a yellow color, but showing no tendency to crystallization, occupying about one-tenth part of the inside of the cup. On the following day this syrupy liquid had the appearance on the surface of dry gum Arabic, and was gently heaving upwards from some gas being formed beneath the pellicle. Readmitted the air into the receiver and removed the sulphuric acid and the gummy-looking mass to another plate, and covered both with the bell-jar, its edge being greased. My back being turned upon the apparatus, in about ten minutes a somewhat violent explosion took place, without, however, injuring the bell-jar. The bell-jar was filled with dense, orange-red fumes, so dense that I could scarcely see the two cups inside. On removing the bell-jar from the plate, I found that a remarkable change had taken place in the contents of the upper cup. It was now quite full of a white, flaky substance, and a stratum of the same substance was lying upon the glass plate. This substance I examined, and found it to be soluble in hydrochloric acid, and to yield all the reactions of hydrated binoxide of tin. It contained a minute portion of hydrate of metastannic acid, but no protoxide of tin. The yellow, syrupy liquid previously mentioned I believed to have been protonitrate of tin, which had spontaneously decomposed upon being sufficiently inspissated.

Prepared a fresh solution, and evaporated as before for several days in a partial vacuum. When the liquid had assumed the syrupy condition, showing as previously no disposition to crystallize, I removed the cup containing it from the receiver. The substance was entirely soluble in cold water to a clear fluid It yielded with the utmost readiness all the reactions both of nitric acid and protoxide of tin. From the above experiments, I conclude that protonitrate of tin is an uncrystallizable salt, of a yellow color and syrupy consistency, soluble in cold water to a clear fluid; and that, upon being sufficiently inspissated, it is spontaneously decomposed into hydrated binoxide of tin and nitrous acid, that decomposition taking place with explosive violence. Thinking it a dangerous compound, I have not sent a portion of the syrupy liquid to the Academy. The aqueous solution of this nitrate (water 20 parts) remains clear at common temperatures for about a day; but afterwards it becomes cloudy, and after several days is entirely and quietly decomposed into hydrated binoxide of tin and free nitric acid.

Prepared antimony solution as described in previous paper. Evaporated a few drops on a thin watch-glass over sulphuric acid, and examined the dry residue by the microscope. It did not show any crystalline appearances except about the edges of the spot. The remainder of the spot had a reticulated appearance. The crystalline appearance was that of fine double lines.

Evaporated the main portion of the solution, under a bell-jar from which two-thirds of the air had been removed, over sulphuric acid, with some fragments of caustic soda placed upon the plate. After it appeared dry, I allowed several days to elapse to make sure that all free nitric acid was removed. The residue was of a yellowish-white color. Treated this residue with cold-water, and filtered. A portion remained insoluble. The insoluble portion consisted of antimonic acid, into which a portion of the dissolved teroxide had been converted during the process of evaporation. The filtrate was perfectly clear, and gave easily all the distinctive reactions of teroxide of antimony and of nitric acid. The portion dissolved must, therefore, have been a ternitrate of antimony.

Prepared arsenic solution as described in previous paper. Evaporated a few drops on a thin watch-glass over sulphuric acid until perfectly dry, and examined the dry residue by the microscope with a power of 100 diameters. It presented the appear-

ance of bunches of crystals, of which the individual elements appeared to be rhombic plates of a white color, opaque, and very deliquescent, so much so that the crystals while being examined were dissolving, and in a short time were entirely fluid.

Evaporated the main portion of the solution, under the same conditions exactly as with the tin and antimony. Allowed to stand two weeks after it appeared to be dry, and then proceeded to examine. The substance was white, opaque, and very deliquescent. Applied every test for nitric acid, but could get no reaction. It will be remembered that, in my last paper, I stated that I had obtained the tests for pentoxide of arsenic, without mentioning whether teroxide were present or not. After evaporation to dryness in the cold, I find that teroxide of arsenic is absolutely absent, and in its stead I obtained all the peculiar and distinctive reactions for pentoxide of arsenic. I therefore conclude that, even if there be a nitrate of arsenic in a solution freshly prepared as previously described, it is probable that it cannot be isolated, for during evaporation, even in the cold, it is entirely converted into arsenic pentoxide.

APRIL 3.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-nine members present.

APRIL 10.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-five members present.

Papers entitled "On the Cambari of Northern Indiana," by Wm. F. Bundy, and "On Lavendulite from Chili," by E. Goldsmith, were presented for publication.

Remarks on the Yellow Ant.—Prof. LEIDY remarked that recently while seeking certain animals beneath stones in the woods of our vicinity, he had had the opportunity of observing the Yellow Ant, *Formica flava*, in possession of large numbers of other insects. This fact, in itself common enough, in one respect, was new and of special interest to him, and may be so to others. In one instance a comparatively small colony of the Yellow Ants had three different insects in their possession, consisting of a species of *Aphis*, a *Coccus*, and the larva of an insect, probably coleopterous. The Aphides were kept in two separate herds, and these were separated from a herd of Cocci. The larva was in the midst of one of the former herds. In a larger colony of the Yellow Ants, there was a herd of Aphides which occupied the under part of one margin of the stone and was almost ten inches long by three-fourths of an inch in breadth. The same colony also possessed a separate herd of Cocci, closely crowded and occupying almost a square inch of space. In both colonies the *Aphis* and the *Coccus* were the same. The *Aphis* is pale yellow with white tubercles on the dorsal surface of the abdominal segments. The *Coccus* is of a dark-red hue. Both Aphides and Cocci with few exceptions adhered to the under surface of the stones, and were not attached to roots. They appeared to be carefully attended by the ants, which surrounded them. The larva alluded to was almost six millimetres long, was covered on the back with a thick white cotton-like secretion. It was also carefully attended by the ants, which were frequently observed to stroke it with their antennæ. The Aphides and Cocci were all in good condition, but without visible means of subsistence excepting the neighboring grass roots partially extending into the earth beneath the stones, to which it is probable they were at times transferred by their masters.

On Cœcum of Capybara.—Dr. H. C. CHAPMAN stated that in making a post-mortem examination of the Capybara (*Hydrochœrus Capybara*), which recently died at the Zoological Garden, his attention was particularly called to the size of the cœcum, which measured thirty-four inches in length, with a circumference of eighteen inches in its widest portion. Not only is the organ relatively enormous when compared with the size of the animal, but absolutely so when it is remembered that the cœcum in the horse and rhinoceros, while more capacious, attains, however, only a length of thirty and thirty-six inches respectively.

As regards the form of the cœcum, with the exception of the blind extremity being more obtuse than is usually seen in rodents, there was nothing peculiar. Noticeable, however, was its marked sacculated condition, due to the well-developed longitudinal bands.

Length of Capybara	38	inches.
" " small intestine	248	"
" " large intestine	48	"
" " cœcum	34	"

On Reflex Action in Turtles.—Dr. H. C. CHAPMAN remarked that he took the opportunity of calling attention to the fact that decapitated turtles exhibit a responsive action to the application of acetic acid similar to that first observed by Pflüger in frogs. Not having at his disposition a frog, and wishing to demonstrate some of the phenomena of reflex action, he decapitated a turtle, and three hours afterward applied a drop of acetic acid to the anus. Almost immediately both the posterior extremities came from out of the shell, and, turning towards each other, with flexed toes made efforts to remove the acid. Twenty-four hours later he repeated the experiment, with the same result.

APRIL 17.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-one members present.

A paper entitled "Report on the Brachiopoda of Alaska and the Adjacent Shores of Northwestern America," by W. H. Dall, was presented for publication.

The election of Dr. J. Gibbons Hunt as Professor of Histology and Microscopic Technology was announced.

On Intestinal Parasites of Termes flavipes.—Prof. LEIDY remarked that in seeking small animals beneath stones and fragments of wood in our forests, observing the very common White Ant, *Termes flavipes*, he noticed that the intestine of the insect,

seen in the translucent abdomen, was distended with brown matter. Feeling curious to learn the exact nature of this matter, he was surprised to find that it consisted largely of infusorial and other parasites, mingled with minute particles of decayed wood. In many instances the parasites are so numerous as to make up the greater portion of the bulk of the intestinal pulp. Every individual he had examined, of workers, soldiers, and winged forms, was infested with the parasites, which may be estimated by millions. As the discovery to him of this new world of parasitic life was recent, he had not yet had time to sufficiently examine scientific literature to ascertain whether the parasites had been discovered and described by others. M. C. Lespes, in a memoir on the organization of the *Termes lucifugus* of France, published in the *Annales des Sciences Naturelles* for 1856, remarks that the intestine is usually occupied by a kind of brown pulp, a living agglomeration of infusoria, and in another paper in the same volume, after describing a nematoid worm, *Isacis migrans*, infesting the Termes, he remarks that he had found in the intestine of the insect a great quantity of parasites, upon which he proposed to say something in future.

The parasites observed in our White Ant consist of five different kinds, of which three are animal and two vegetable in character. One of the latter consists of filaments of the algoid form he had once described under the name of *Arthromitus*, the other not so frequent is a *Spirillum*, probably *S. undula*.

The animal parasites, of which drawings were exhibited, are as follows:—

1. TRICHONYMPHA AGILIS.

This is a remarkable creature of obscure affinity, but probably related with the *Turbellaria* on the one hand and by evolution with the *Ciliate Infusoria* on the other. The animal is about $\frac{1}{350}$th of an inch long and about half the breadth of the length. It is fusiform, and is clothed with ciliate hairs of extraordinary length. The head is mammilliform; the posterior end of the body from subacute to obtuse according as it is narrowed or shortened by contraction. The cilia investing the body appear to consist of three sets: the shortest ones waving outwardly and downward from the head; a second set extending from the head the length of the body, incessantly waving downward and swelling outwardly; and the third set, the longest of all, extending from the head beneath the others in a longitudinal spiral manner far beyond the posterior end of the body, where they form a loosely twisted fascicle with divergent ends. The arrangement of the long cilia, clothing the body, reminded him of the nymphs in a recent spectacular drama, in which they appeared with their nakedness barely concealed by long cords suspended from the shoulders, and this arrangement has suggested the name applied to the parasite.

He was not positive whether he had been able correctly to interpret the interior structure of the animal, but it appeared to him to resemble more that of the *Rhabdocœla* than that of any of the *Protozoa*. No appearance of vascular or nervous system could be detected. The animal appeared to be capable of ingesting particles of solid food frequently observed in considerable quantity in the stomach occupying the posterior two-thirds of the body. The mouth apparently was a rounded pore at the summit of the head. From this a narrow tube expanded in a pharyngeal pouch communicating behind with the capacious stomach. An anal outlet may exist at the back end of the body, but was not detected. Opposite the conjunction of the pharyngeal pouch and the stomach, a granular nuclear body is constantly observed.

Trichonympha, though incessantly and actively in motion, usually remains stationary in position, but occasionally advances with feeble jerking propulsion. The chief movements consist in frequent retraction or shortening and bending of the cephalic end with rapid waving and swelling outwardly of the long ciliary hairs. The motion of the latter resembles the flowing of a thin sheet of water over the brim of a fountain vase or basin swayed to one side or the other by a current of wind. The longest cilia, extending beyond the back of the body in a loosely twisted fascicle, are the least active, but at times stretch outwardly and become more divergent at the ends, or they become more closely applied to the sides of the body. When the head is bent to one or the other side, with the summit directed forward, it gives rise to an appearance resembling the spiral peristome of a *Stentor*. Viewed on end, the parasite appears circular with long divergent cilia, and reminds one of the upper view of a *Vorticella*.

2. PYRSONYMPHA VERTENS.

The remaining two animal parasites are Infusoria. The larger of the two is often more abundant than the *Trichonympha*, and is about the $\frac{1}{300}$th of an inch in length. It is more delicate, less distinctly defined, and undergoes rapid dissolution after removal from the intestine of the Termite. It is elongated fusiform, or when shortened clavate or pyriform in outline. Like *Trichonympha*, it usually remains stationary in position, while actively moving, writhing, apparently twisting, and often bending in a waving manner from one extremity to the other. In motion, longitudinally spiral and parallel lines become more or less evident, and frequently cause serrated projections at the extremities, or at the prominence of the bends when produced at the lateral borders. These exhibit a rapid waving motion, strikingly resembling the movement of flames, and probably denoting the presence of minute cilia, though these were not positively seen. A narrow band extends the length of the body, sometimes projecting at one end, and moves in long, angular waves, flexing the body in ac-

cordance with its movement. The body appears to be composed of finely granular protoplasm, with but faint distinction of endo and ectosarc. A large oval or round granular nucleus occupies a position in advance of the middle of the body. The position of the mouth was not detected, though one is most probably present, as the animalcule is often replete with large particles of food, consisting of bits of wood. *Pyrsonympha* may be the larval condition of *Trichonympha*, though there is no evidence that such is the case.

3. DINENYMPHA GRACILIS.

A Ciliate Infusorian, the smallest and most abundant of the three animal parasites, about $\frac{1}{150}$th of an inch in length, is flattened, fusiform, and in motion often twisted. It is longitudinally and, in the twisted condition, spirally striated, and is invested everywhere with fine cilia. The animal usually, remaining like its companions nearly stationary in position, writhes from side to side, shortens and widens, or lengthens and contracts, and rotates in the long axis. The longitudinal lines of the body by contraction produce a serrated appearance at one end, or at the prominences of the lateral borders when the body is twisted. The interior of the body is finely granular, often with one or more large globules, probably consisting of a nucleus, and at times of contractile vesicles or vacuoles. No mouth could be detected, although one probably exists, as the animal often contains particles of solid food, sometimes comparatively of enormous size.

The great accumulation of parasites, apparently constantly existing in the White Ant, one of our most common insects, will afford a new and wonderful source of delight to our microscopists. They should be examined in a denser liquid than water, as this produces their rapid destruction. The white of egg thinned with water, Prof. L. finds to be a good medium in which to examine these and other minute parasites from the interior of animals.

The nematoid worm *Isacis migrans*, discovered M. Lespes, so abundantly existing within the *Termes lucifugus*, and also externally in the nest of this insect, in France, Prof. L. had occasionally found in the *Termes flavipes*.

On the Eucalyptus Globulus.—JOSEPH WHARTON remarked that about five years ago he wrote to London for seeds of the *Eucalyptus globulus*, and had them planted in his green-house in the early spring of 1872. The young trees throve well there, and, when transplanted, grew vigorously in the open air until the approach of winter led him to remove them to the green-house. By thus putting them in the open air every spring, and replacing them under glass during the winter, they continued to grow until in the fall of 1876 he gave several to the horticultural department of the Centennial Exhibition, and several to a friend; others he

house as before. The plants at the Centennial Exhi- ned a height of about 20 feet, and were, when he last till flourishing, though rather too slim; those given his d were cut down on account of being too spindling, and are reported as being sturdy; those in his own hands grew out of doors as usual last summer, but, instead of being taken in on the approach of winter, they were laid down and covered with leaves and earth, in order to test their ability to resist in that way our winter climate. Upon taking them up this spring every one of them was found to be quite dead.

His o t in raising these plants was to learn whether any chance e ted of acclimating them here or in the swamps of New Jersey in the conviction that there is no r lt; though several hard frosts late in meter as low as 25° F., had on several o no injury beyond the shrinking of leaves, the winter them out of doors with all precautions, a... matu y had been attained, ended, as has been sai th of h specimens.

Having read produces divers species of *Eucalyptus*, among them row high up the hills, he wrote, in 1875, to Baron v e accomplished manager of the Botanic rden- irne, for information as to the probabl any such species or varieties to withstand our winters, o as to the power of these trees to banish such insects as the Jersey mosquito. He replied that the hill species were less valuable and important than the *globulus*, that some of them would be likely to survive here, and that he should not expect them to avail against troublesome insects.

As a green-house plant he found the *Eucalyptus globulus* in its early years decidedly attractive. Its foliage is of a peculiar color (hence its common name of blue gum), and the leaves are covered with a sort of bloom from the exudation of its aromatic resin. Its pungent and spicy or camphory odor was to him decidedly agreeable; that this odor is supposed to be health-giving, or destructive of malaria, another common name of the *Eucalyptus*, viz., fever-tree, sufficiently attests. There is not the slightest difficulty in growing the plants from seeds in an ordinary sand-bed in a green-house.

APRIL 24.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

Papers entitled "On the Evolution and Homologies of the Incisors of the Horse," by John A. Ryder, and "Synopsis of the

Fishes of Lake Nicaragua," by Theodore Gill, M.D., and J. F. Bransford, M.D., U. S. N., were presented for publication.

The Mineralogical Section reported its organization, and the election of the following officers:—

Director—Theo. D. Rand.
Vice-Director—Wm. H. Dougherty.
Conservator—Jos. Willcox.
Secretary—H. C. Lewis.
Treasurer—Wm. S. Vaux.
Recorder—H. C. Lewis.

Jos. G. Rosengarten, Edgar F. Smith, Ph.D., J. Marshall Stoddart, Jr., and Gertrude K. Peirce were elected members.

The following papers were ordered to be published:—

ON THE EVOLUTION AND HOMOLOGIES OF THE INCISORS OF THE HORSE.

BY JNO. A. RYDER.

In the course of investigations made to determine the origin of the type of incisors found in the horse, it was noticed that the slightly worn third lower incisor from a horse, not adult, bore a very striking resemblance to the incisors in *Paloplotherium* and *Palæotherium*, which are regarded by Kowalewsky and others as ancestral forms of *Equus*. The tooth in question, which gave a foundation to this supposition, agrees remarkably in form with the incisors of the older genera mentioned, in the form of the posterior basal ridge, which seems to be destined to form the posterior wall of the central pit, or cul-de-sac—"mark" of horsemen. This posterior basal ridge in the third tooth in the state of development at the time of observation, occupied much the same relative position to the space between it and the worn surface in use at the anterior border of the crown, as the supposed homologous ridges in the aforementioned eocene and miocene forms. That the space between the posterior basal ridge and the worn surface functionally in use, is destined to become the central pit or cul-de-sac of the tooth is proved by the condition in which we found the third lower incisor under consideration, and the condition of the second alongside of it. The posterior basal ridge in the third has not yet been reached so as to be worn, and the second still retains marked traces in section of the lateral grooves. These seem to be the remains of the notches that once in bunodont forms separated the tubercles, which formed a festoon (cingulum) above the cervix of the tooth posteriorly, as observed in the upper inner incisor of *Dicotyles*.[1]

The posterior basal ridge in this outer lower incisor is also faintly marked off laterally, by a shallow longitudinal groove,

[1] Since writing the above we have had an opportunity of examining in the Zoological Gardens the incisors of a young female donkey, in which the condition of development had not reached the state detailed in the text. Even the inner incisor exhibits, when looked at from above, traces of the parentage of the hinder wall of the cul-de-sac, while the outer one is still more nearly like the same tooth in *Palæotherium*.

from the anterior portion of the tooth, and a slight notch is present in the middle of its crest.

The second incisor above, not yet protruded from the alveolus, has a marked groove running along the posterior face of the tooth longitudinally, a little more than .1 inch from its outer edge where the posterior wall (posterior basal ridge) of the central pit seems to be united with the anterior. There is also a central longitudinal groove in the posterior wall, the wall being slightly inflected along the course of the groove towards the centre of the pit. The posterior wall (posterior basal ridge) is also considerably shorter than the anterior in this tooth, which was observed to be the case in all of the incisor teeth before being protruded from the alveolus.

A. Right upper incisors of adult horse, fully worn, all traces of the basal ridges being obliterated as such, and now bounding the hinder borders of the pits.

B. Left lower incisors of young horse: the first tooth fully worn, the second partly worn, showing the points of junction of the basal ridge with the anterior part of the tooth, while in the third tooth the basal ridge is not yet worn.

C. Second and third upper incisors of *Palæotherium medium*, showing basal ridge. (After Gervais.)

D. Left lower incisors of *Paloplotherium minus* with basal ridges. (After Gervais.)

When the worn faces of the teeth are looked at from above, it is observed that the two edges of the enamel plates forming the anterior and posterior faces of the anterior and posterior walls are closer together in the posterior than in the anterior one, showing that the posterior has been the last to be brought under the influence of wear and that the posterior is likewise not as strong nor as fully developed, retaining, as it were, in its weakness, evidence of its later origin. In regard to the homology of the median groove and notch in the posterior wall of the central pit, there seems to be reason for believing that they are the remains of the space separating the lateral posterior oblique basal ridges of the incisors of such unspecialized forms as *Anthracotherium* and many others.

Amongst other perissodactyle mammals, as in *Tapirus*, in the upper incisors the posterior basal ridge is produced and almost as high as the anterior. The space between the two is sub-triangu-

lar, very shallow, convex from side to side, concave antero-posteriorly, and covered with a thick enamel layer. In *Palæotherium* there is a marked internal basal ridge on the canine, which is very slightly marked in the horse. In giraffe, the basal ridge seems to be developed in much the same way as in *Palæotherium*, in the third incisor at least, but has not advanced so high up the posterior face of the tooth.

These facts seem to point to but one conclusion, viz.: that these basal ridges are homologous, and that the space between the anterior wall, the primitive functional part, and the posterior wall (basal ridge), is the rudimentary cul-de-sac, and that sooner or later they are accelerated, becoming functional; or, are retarded, remaining rudimentary or disappearing altogether.

If we regard the dental system of *Equus* as an acceleration of the dental system of the primitive hippoid types, as has been shown by the results of the researches of Professors Leidy and Marsh, a clear explanation is at once afforded of the homologies of the parts of the teeth. The relatively short teeth of the earlier, and the relatively long ones of more recent forms, if we contrast the molars and incisors, seem to indicate that the acceleration was synchronous. The relatively short basal ridges of the early types were produced in a constant ratio with the production of the molar and incisive elements, culminating at last in the relatively complex incisive dentition of modern *Equus*. This view is verified by the embryological history of the teeth in the horse, where we actually have a sort of repetition of the forms of the incisors of earlier types.

REPORT ON THE BRACHIOPODA OF ALASKA AND THE ADJACENT SHORES OF NORTHWEST AMERICA.

BY W. H. DALL, SMITHSONIAN INSTITUTION.

Having during the last ten years had an opportunity of examining nearly all the known material, much of which is derived from the collections of myself and party during the period mentioned, I am able to present what appears to be a tolerably complete synopsis of the species inhabiting the northwest coast from Santa Barbara Channel, California, to the Arctic Ocean. To this I have added the results of some study of the general subject, regarding the relations of certain groups of species and a hypothetical explanation of certain very singular facts.

TEREBRATULIDÆ.

1. Terebratulina unguicula.

Terebratula unguicula, Cpr. P. Z. S. Feb. 14, 1865, p. 201, fig. 1-4. Cooper, Geogr. Cat. Cala. Moll. p. 3, 1866.

Terebratulina unguicula, Dall. Cat. Recent Brach., Proc. Phila. Acad. Nat. Sci., p. 177, 1872.

T. juniore "*Terebratulinæ capiti-serpentis*" simillima, sed latiore; costis conspicuis, interdum obtusioribus, aliis intercalantibus; testa adulta valva inferiore subelongata, inflata, marginem versus haud planata; umbone valde tumente, latiore, aperta; striis radiantibus conspicuis; marginibus granulatis, undulatis; intus amento majore, latiore, annulato, bisinuato, in testa juniore dorsaliter interrupto. Lon. 15 mm.; Lat. 12 mm.; Diam. 9 mm.

San Diego, Cal., to the Aleutian Islands. San Pedro, Cal., Cp.; Monterey, Cp.; Neeah Bay, W. T., Swan; Victoria, V. Id. Lord, J. Richardson; Port Etches; Shumagin Islands; Unalashka; Dall. Range, low water to 100 fathoms, those from deep water the largest, adhering to shells and stones. Thirty-eight specimens examined.

This species is readily separated from *T. caput-serpentis*, *T. Japonica* and other species, which strongly resemble it externally, by the broad loop which is usually open instead of being closed as the genus requires. However, it finally becomes closed in fully adult specimens which reach the size of *T. caput-serpentis*. In

describing it from immature examples, Dr. Carpenter was led by this peculiarity to describe it as a *Terebratula*, and it was a number of years before I was able to find a fully developed specimen. All that I have seen from southern localities have been immature.

2. Terebratella frontalis.

Terebratula frontalis, Midd. Malak. Ros. III, p. 2. Sib. Reise. II, p. 241, pl. 18. fig. 9-14, 1847.

Terebratella frontalis, Dall. Cat. Rec. Brach, l. c. p. 184.

T. suborbiculari, solidula, calcarea, incrementi periodis irregularibus aspera, sordide lutescente; valvis convexitate æqualibus; linea marginali rectiuscula integerrima; valva dorsali postice producta, vix recurva, late truncata, foramine magno, latius aperto, interrupto; area cardinali augusta, utrinque interiora versus dente cardinali terminata; valva hæmali suborbiculari aut transversim ovali, sulco mediano nullo; apophysis "*Terebratellæ*" formis: Lon. 18 mm., Lat. 18 mm., Diam. ventr. 9 mm.

Western Aleutians from Atka Island westward; the Okhotsk and Japan Seas. Atka, Amchitka, Attu, Dall; Okhotsk Sea, Middendorf; Japan Seas, Capt. St. John. Range from low-water mark to forty fathoms. Sixty-five specimens examined.

The rude appearance, ashen color, and remarkably wide foramen distinguish this species from any other of the genus.

3. Terebratella occidentalis.

T. occidentalis, Dall, Proc. Cal. Acad. Sci., 1871, IV, p. 182, 1871, pl. I, fig. 7.

Waldheimia Grayi, of Cala. authors, not of Davidson.

T. transversa, rosacea aut miniata, costis radiantibus angulatis ornata; valvis flexuosis, convexiusculis lateraliter angulatis; margine cardinali lente curvato; apice vix eminente; foramine magno, interrupto, latius aperto; cardo et apophysis ut in "*Terebratella;*" area cardinali angusta, lata, conspicua. Lat. 18 mm., Lon. 12 mm., Diam. ventr. 5 mm.

San Francisco to Monterey, Cal. Pigeon Cove, Stearns; Monterey, Dall, Canfield, Cooper. Near low-water mark, to —? fathoms. Five specimens examined.

This rare species externally resembles, in its sharp ribs, transverse form, and deep crimson coloring, the above-named species from Japan, but it is a *Terebratella*, and authentic specimens of *T. Grayi* show that species to be, as it was described, a *Waldheimia*. The color and deeply notched margins distinguish it from

the common northern *T. transversa*, the only species with which it is likely to be confounded. It is probable that careful search would reveal the habitat of this species, when it might be found more abundantly. Most of the specimens known have been picked up on the beach.

4. Terebratella transversa.

Terebratula transversa, Sby. Thes. Conch. 1, p. 261, pl. 72, fig. 114–115, 1846. Not of Gould, Proc. B. S. N. H. vii, p. 323, 1860.

Terebratella caurina, Gould, Proc. B. S. N. H. iii, p. —, 1850. Exped. Shells, p. 468, pl. 44, fig. 582.

Terebratella caurina, Gld. Otia Conch. p. 97, 1862. Cpr. Sup. Rep. B. As. p. 636, 1864.

Terebratella transversa, Dall. Cat. Rec. Brach. l. c. p. 185.

T. variabilis, fusco-cinerea, transversa, convexiuscula; costis angulatis numerosis interdum bifurcatis plerumque radiata; margine ventrali flexuoso; apice acuto, angulari; rostro brevi, curvato, foramine magno, interrupto; area cardinali elevata, lata, planata, margine carinato; apophysis curta, "*Terebratellæ*" aliis simillima. Lat. 25–40 mm., Lon. 16–25 mm., Diam. ventr. 5–15 mm.

Shumagin Islands to Oregon. Coal Harbor, Shumagins; Semidi Islands; Kadiak; Port Etches; Sitka Harbor; Dall. Victoria, V. Id., J. Richardson, Hepburn; Neeah Bay, Swan; Puget Sound, Kennerly; Oregon, U. S. Expl. Exped. Range from low-water mark to twenty fathoms. Sixty specimens examined, including Gould's type.

This abundant species is very variable in form and size; the northern specimens are the largest. Some are as transverse as a *Spirifer*. Gould's *T. transversa* from Japan was never figured, and cannot now be identified. It was not this species, which has in any case the priority. Sowerby's figure is sufficiently characteristic to render its identification with Gould's *caurina* tolerably certain.

The transverse form in most cases, the ashen-gray color and coarse ribs render its identification easy.

5. Laqueus californicus.

Terebratula californica, Koch, Kuster's Martini, viii, pl. 26, figs. 21–23.

Waldheimia californica, Gray, B. M. Cat. p. 60, No. 8, Cpr. Sup. Rep. Br. As. p. 568, 636.

Laqueus californicus, Dall, Am. Journ. Conch. vi, p. 123, 1870; pl. 7, fig. f., pl. 8, fig. 9–10. Cat. l. c. p. 186.

T. magna, rhomboideo-ovalis, valde inflata, tenuis, rufescente,

striulis incrementi solum insculpta; valva hæmali ventricosa, sulco mediano nullo, margine postico vix angulato; valva dorsali posticè rostrata, foramine minimo, integro; rostro brevi valdè incurvato; apophysis ut in "*Laqueus*." Lat. 45 mm., Lon. 55 mm., Diam. 35 mm.

Port Etches, Prince William Sound, to Catalina Island, Cal. Port Etches, Dall; Victoria, J. Richardson; Catalina Id., Cooper. Range from fifteen to one hundred and twenty fathoms, the larger specimens generally from deep water. Twelve specimens examined.

This species may be recognized by its large size, smooth rufous exterior, and small and complete foramen. It somewhat resembles *Waldheimia venosa*, from Cape Horn, but has not the strongly marked venations, and is of a different form and color. It is everywhere rare, owing to its deep-water habitat.

6. **Megerlia Jeffreysi.**

Ismenia? Jeffreysi, Dall, Am. Journ. Conch. vii, p. 65, pl. xi, fig. 7–10, Mar. 1871.

Megerlia (*Ismenia*) *Jeffreysi*, Dall, Cat. l. c. p. 187.

Waldheimia cranium, jun., Friele (ex parte) Vidensk. Forh. p. 2, pl. i, f. 9 a–i, 1875.

Testa parva, lenticularis, tenuis, orbiculato-trigona, cinereo-alba; valva minor convexiuscula, suborbiculata, margine recto, apice inconspicuo, vix angulato; valva major convexior, apice truncato, brevi, recto, foramine modico, interrupto; area cardinali inconspicua; apophysis tenuissima, plerumque exilis, "*Megerliæ sanguiniis*," simillima. Lon. 10 mm., Lat. 10 mm., Diam. ventr. 4 mm.

Deep water, N. E. Atlantic; Semidi Islands to Victoria in the Pacific. N. E. Atlantic, 155–345 fathoms, Jeffreys, with *Waldheimia cranium*. Semidi Islands; Port Etches; Dall.; Victoria, V. Id., J. Richardson. Sixteen specimens examined. For so rare a shell this has an extraordinary range. It much resembles the young of the last species, but never attains much greater size than half an inch in diameter, and has an incomplete foramen. The color varies from ashy yellow to rufous. The specimens from the northwest coast were obtained in from fifteen to twenty fathoms water.

It is probable that it has frequently been taken for the young

of other species, and that a careful examination of small specimens would much extend our knowledge of its distribution.

The septum is generally almost evanescent.

7. **Magasella aleutica.**

Magasella aleutica, Dall., Proc. Cal. Acad. Sci., Dec. 1872, p. 302, pl. I., fig. 6. Cat. l. c. p. 188.

T. parva, subinflata, solida, orbiculato-trigona, rosacea aut concentricè rubido-picta; valva minor convexa, suborbiculata, margine leviter sinuato, apice inconspicuo; valva major convexior, apice erecto, truncato, conspicuo, foramine amplo interrupto; area cardinali distincta, apophysis tenuissima, septum conspicuum munita. Lon. 10 mm., Lat. 9 mm., Diam. ventr. 4 mm.

Aleutian Islands to Port Etches.

Kyska Id.; Adakh Id.; Atka Id.; Unalashka Id.; Shumagin Ids.; Port Etches; Dall. Range from low water to ten fathoms. Fifty specimens examined.

This little species differs externally from the young of *T. frontalis*, only by its rosy color and neater proportions; from young *L. californicus* by its open incomplete foramen, and from the last species by its greater solidity, bright tints, loop, and prominent septum. It has somewhat the aspect of *M. inconspicua*, Sby., from New Zealand.

8. **Magasella radiata**, n. s.

M. testa minuta, cuneata, triangulata, radiato-costata; haud inflata; costis radiatis circa xvi. ornata; lineis concentricis sparsim striata; foramine aperto, interrupto; deltidium nullum; apice subacuto; testa lutea aut cinereo-alba. Lon. 0.5 mm., Lat. 5 mm., Lon. neural valve, 4 mm.

Shell small, nearly triangular, the greatest width near the anterior margin, which is gently rounded; somewhat flattened or compressed, with about sixteen moderately strong radiating ribs or costæ on each valve. These are continuous from the beak to the margin, not divaricating; some lines of growth well marked; foramen incomplete, large; apex rather acute; color waxy or ashy-gray. Interior as usual in this genus, with a strong septum. Shell quite solid and strong. Length 0.2 in.; of neural valve 0.17 in.; width 0.2 in.

Popoff Strait, Shumagin Islands; one specimen, with *M. Aleutica* adhering to stones at lowest spring tides.

This species is quite distinct from any other in the region. It

is sculptured somewhat like *T. transversa*, from which it is sufficiently distinguished by its form, absence of median flexure, size, compression, and apophyses. It also recalls in some respects *M. Patagonica*, which has divaricating costæ, and is of a different shape.

RHYNCHONELLIDÆ.

9. **Rhynchonella (Hemithyris) psittacea.**

Anomia psittacea, Gmelin, Sys. Nat. 3348.
Hemithyris psittacea, D'Orb. Pal. Fran. Ter. Crèt. IV. p. 342, 1847.
Rhynchonella psittacea, Auct., Rve. Conch. Ic. pl. 1, fig. 2, a–c.
Hemithyris psittacea, Dall. Cat. l. c. p. 196.
Rhynchonella Woodwardi, A. Ad. Dav. P. L. S. 1871, p. 309.

T. subglobosa, postice acuminata, tenui, cornea, nigricante; valvis inæqualibus, radiatim concinne sulcatulis; linea marginali ex umbone declivi, demum ascendente et antice valde sinuata; valva dorsali postice acuta, recurva, antice deflexa, sulco mediano, lato, area cardinali inconspicua, deltidiis augustis, ad latera foraminis coalescentibus; valva hæmali, ventricosiore, dentibus cardinalibus internis ex umbone porrectis, recurvis duobus; margine valvarum integerrimo. Lon. 25 mm., Lat. 22 mm., Diam. ventr. 16.5 mm.

Boreal and Arctic Seas. On the northwest coast from Fuca Strait to the Arctic; Japan; North European Seas; everywhere abundant.

This well-known species is of circumpolar distribution, varying in depth from low-water mark to two hundred fathoms or more. In examining specimens from the shores of Alaska, I thought at first that by their coarser growth and grooving they were distinguished from Norwegian specimens. But after an examination of several hundreds of specimens, I have been forced to conclude that the differences noted were only individual or local peculiarities. I have observed in a few instances the brachial "arms" protruded from the shell in living examples.

LINGULIDÆ.

10. **Glottidia albida.**

Lingula albida, Hinds, Voy. Sulph. p. 71, pl. 19, fig. 4, 1844.
Glottidia albida, Dall. Am. Journ. Conch. vi. p. 157, pl. 8, fig. 1–6, 1870. Cat. l. c. p. 204.

T. oblonga, levi, complanata, anticè truncata, albida seu brunneo-maculata; valva major, intus laminis duobus ex umbonem

divaricatis; valva minor, lamino uno, mediano, prope apicem munito; pediculo plerumque brevi. Lon. test. 25 mm., Lat. 10 mm., Lon. tot. 50 mm.

Monterey, Cal., southward.

Monterey, Dall.; Santa Barbara, Stearns, Newcomb; Catalina Island, Cooper; San Diego, Hemphill; ten to sixty fathoms, muddy bottom, rarely on tidal flats in mud at lowest water.

This species has not been found to the northward of Monterey, though it may yet turn up somewhere. It is usually not over three inches in length, peduncle included. Like other species of *Lingulidæ*, when young it is free, and burrows in the mud. Adult specimens, with favorable opportunity, often fasten themselves to a pebble or fragment of shell by the distal extremity of the peduncle. This has been also observed with *Glottidia pyramidata*, Stm., in Florida, by Mr. F. B. Meek, though that species had been supposed to be always free. It would seem probable, from information communicated to me by Mr. Meek, that these creatures are of rapid growth, and live at most but one or two seasons. It is the only species of the *Lyopomata* yet found on the northwest coast.

The following species, or supposed species, have been erroneously referred to the northwest coast, sometimes from mistaken identity and sometimes from other causes.

a. *Terebratulina caput-serpentis*, L., in error for *T. unguicula*, Cpr. Real habitat, North Atlantic.

b. *Waldheimia Grayi*, Davidson, by erroneous identification with *Terebratella occidentalis*, Dall. Real habitat, Japan.

c. *Terebratella Coreanica*, Ad. & Rve., by erroneous identification with *T. transversa*, Sby. Real habitat, Japan Seas.

d. *Terebratella pulvinata*, Gld. Erroneous habitat caused by confusion of U. S. Exploring Expedition labels. Real habitat, Tierra del Fuego and vicinity.

e. *Discina striata*, Schum., as *Orbicula Evansi*, Davidson, "Bodegas." Real habitat, Cape Palmas, W. Africa, and vicinity.

In this connection it may be allowable to call the attention of naturalists to certain facts connected with the group of arthropomatous brachiopods which have been with me for some years a subject of reflection. Not having been able to suggest any

satisfactory explanation of the relations which appear to exist between certain groups of the *Terebratulidæ*, I desire to draw the attention of others to them, in the hope that some solution may be arrived at, and to place the facts on record. In 1871 I proposed the name of *Magasella* for a group of *Terebratulidæ*, mostly composed of small species, and characterized, among other things, by an incomplete foramen and a high septum, standing up from the middle of the brachial valve, and to which the loop is attached or appressed for a considerable portion of its length.

This section of the family has been recognized as valid by several competent naturalists. There are known, in all, about eleven well characterized species of this group, beside one doubtful species, *M. crenulata* Sby. Four of these species have been described by myself, and most of the others, not recently described, have but lately been discriminated from species of *Terebratella*, etc. In working over the group certain facts become prominent, which cannot be without significance when carefully considered. These facts may be formulated as follows:—

I. Each species of *Magasella* (with the exception of its generic characters of apophyses and foramen) has a more or less pronounced likeness to some species of another section of the *Terebratulidæ*. This likeness, in some cases, approaches identity when the generic characters and size are taken out of the question.

II. The species resembled are invariably members of a section of the family possessing a long or complicated loop, and usually a median septum. In fact most of them are Terebratellas.

III. The species resembled, usually though not invariably, inhabit the same faunal region as the particular species of *Magasella* which may be under consideration, and are often found living with the latter in the same localities.

IV. When there is an abundant species of *Terebratella*, for instance, on any coast, it is almost invariably accompanied by a species of *Magasella* of similar specific characters.

This law is so invariable in well explored regions, that I should feel hardly any hesitation in predicting the existence of a companion *Magasella*, in a region not thoroughly explored, when the prevalence in that region of a species of the section *Magasinæ* became known.

V. The genera *Terebratella* and *Waldheimia* being the most abundantly represented of any of the genera of recent brachio-

poda, may be said to represent to some extent the most fully developed of the brachiopods; an inference borne out by the complication of the loop as compared with that of other groups. The loop of *Magasella*, being the most complicated of any (except the few species of *Megerlia*), may thus be the latest exhibition of evolution in this direction. The genus *Magas* (with which *Mannia* of Dewalque may perhaps be synonymous) is not very closely related to *Magasella*, and leaving it out of the question it may be added that, so far as known, *Magasella* occurs only in a recent state; another argument for its comparatively modern evolution.

In illustration of the above, the following parallel lists may be adduced showing the several species of *Magasella* with their companion species of other groups and the region to which they belong. Such as exhibit specially remarkable similarity in specific characters are marked with an asterisk; those exhibiting only a general resemblance are not so marked.

Magasella Adamsi, Dav.	?	Japan.
M. aleutica, Dall.	*Laqueus californicus*, Koch.	Alaska.
M. Cumingi, Dav.	?	New Zealand.
M. Evansi, Dav.	*Terebratella cruenta*, Dillw.	New Zealand.
M. flexuosa, King.*	*Terebratella dorsata*, Gmel.	Patagonia.
M. Gouldii, Dall.	*Waldheimia Grayi*, Dav.	Japan.
M. inconspicua, Sby.*	*Terebratella rubicunda*, Sol.	New Zealand.
M. lævis, Dall.*	*Terebratella pulvinata*, Gld.[1]	Patagonia.
M. patagonica, Gld.*	*Terebratella dorsata*, Gmel.	Patagonia.
M. radiata, Dall.	*Terebratella transversa*, Sby.	Alaska.
M. suffusa, Rve.	?	Unknown.

With some hesitation I add also—

Megerlia Jeffreysi, Dall.*	*Wald. cranium*, Müll.	N. E. Atlantic.
Megerlia sanguinea, Ch.*	*Wald. picta*, Ch.	Indo-Pacific.

Of the three species queried, *M. Adamsi* resembles *Waldheimia Grayi*, jun., in a general way except in coloration; *M. Cumingi* is very peculiar, unlike any other recent species; and the habitat and probable companion of *M. suffusa* are alike unknown.

I have not included the section *Ismenia* (*Megerlia*) in my preliminary remarks, but the species, cited above, present, in a less

[1] A third, related to *pulvinata* as that is to *lævis*, is *Waldheimia venosa*, Sol.

marked manner, similar peculiarities. The companion of *Ismenia Jeffreysi*, on the Alaskan coast, would be *Laqueus californicus*, to which the Alaskan specimens show some similarity; while those from the N. E. Atlantic offer similarities which are very marked with the young *W. cranium*. Nevertheless, except a slight difference in color and solidity, there are no reasons other than geographical for separating the Atlantic and Pacific shells which I have called *I. Jeffreysi*.

With regard to *W. picta*, I can only judge from figures and the remarks of descriptive authors, who all point out its similarity to *T. sanguinea*. Both are Indo-Pacific in distribution, and have been reported from Japan. In this connection it may be noticed that the *Magasella* and its companion do not always occupy the same region at *all* points, but do usually meet at some common point in their distribution.

In the first portion of the list, the most striking instance of similarity is that which is shown by *Magasella inconspicua* and *Terebratella rubicunda*, jun. These appear absolutely without differential specific characters, though the generic characters of the individuals compared may be clearly marked.

It must be clearly understood and borne in mind, that the similarity between the *Magasella* and its companion is usually only remarkable when the *young* of the latter is compared with the *adult Magasella*. The adult companion shells frequently acquire characters belonging to maturity which, though too intangible to be of specific value, much obscure the original resemblance. At first the idea suggested itself, as a matter of course, that *Magasella* (and *Megerlia*) was an immature form, especially as it wants the median brachial coil as do the immature *Terebratellæ*.[1] The evidence against this hypothesis seems to me to have greater weight than that in favor of it, which latter chiefly arises, as far as *Magasella* is concerned, from the similarity of specific characters, and greater or less agreement in geographical range. Since the preceding portion of this article was written, I have been made

[1] This paper had been prepared and read before the Buffalo meeting of the Amer. Assoc. up to the above point, when the paper by Mr. Herman Friele, published in the Vidensk. Selskab. Forh. for 1875, was received from the author, and afterwards supplemented by a series of his specimens. The subsequent portion has since been recast to more fully present the whole subject.

aware that a species of *Megerlia* (subg. *Ismenia*) has been claimed as the young of *Waldheimia cranium* by Herman Friele. I will defer the examination of this special instance until the general case can be presented.

If *Magasella* be the young of the various forms herein denominated "companions," 1st, the distribution of any two species so related to each other should absolutely coincide; 2d, the young should all be *Magasellæ;* the adults (barring dwarfs), all of the "companion" genus; 3d, actual study of the embryology and young stages should be able to trace the edentulous stage into the *Magasella* stage, and that into the final "companion" stage.

Finally we should expect, with some show of reason, that the relations of the one to the other in development should be in harmony with the development of the group as a whole in geological time and organic differentiation. These expectations, though reasonable, from analogy in a multiplicity of other organisms, are not absolutely to be insisted on, while the three preceding propositions are absolute requirements.

What agreement exists between the facts and these requisites?

1st, as regards distribution: There is abundant evidence that the *Magasella* and its companion are not inseparable. For instance, *M. aleutica* and *Laqueus californicus* meet only about Port Etches, which is the southernmost limit of the first and the northernmost limit of the second. *M. aleutica* in that part of its district, where it is most abundant, has no associate brachiopod of its family except a *Terebratulina*. The same is probably true of *M. radiata*, which is found at the extreme northern limit of *T. transversa*, and is absent where the latter flourishes in abundance. In the second group, *W. picta* is reported from but one locality in Japan, while *Megerlia sanguinea* is rather common there; with regard to their joint occurrence at the Sandwich Islands I am a little suspicious that the *Megerlia* may have been taken for the *Waldheimia* by those unfamiliar with the apophyses, as I have seen large numbers of the former from that locality, but not a single *Waldheimia*.

Again *Megerlia Jeffreysi* appears to be common in the North Sea and North Atlantic, and is not rare in the southeastern portion of Alaska and British Columbia, reaching from the Semidi Islands to Puget Sound, while its Atlantic companion *Wald. cra-*

nium and the genus to which it belongs[1] are unknown in the Pacific district above described, and its Pacific associate has not been found north or west of Port Etches. It is impossible to say whether similar discrepancies occur in the distribution of the other species, as the regions they inhabit have not yet been investigated with any thoroughness.

2d. As regards the young and adult forms: Of several of the species of *Magasella*, the adults, or at any rate the largest specimens which have come to hand, are nearly or quite as large as the "companion" when also adult. This is especially true of the typical species of *Magasella*, *M. Evansi*, of which I have a specimen fully as large as the usual size of *T. cruenta*, and much larger than some of the younger specimens of *cruenta*, which have the typical loop of *Terebratella* proper. The same is true of *M. flexuosa* as related to *Terebratella dorsata;* and Pacific adult specimens of *Megerlia Jeffreysi* are as large as the usual size of *W. cranium* in the Atlantic. Nevertheless it is true that the *Magasellæ* are usually smaller than their "companions."

I have recently had the opportunity of examining a large series of young *Terebratella rubicunda* from New Zealand, and also a lot of *Magasella inconspicua* from the same locality. No two "companions" are more nearly identical in specific characters. In fact no one can separate them without examining the apophyses. Yet in the youngest stages of both (as well as the adults) the generic characters are clearly and unmistakably defined. Mr. Davidson has kindly informed me that he has had a similar experience with *T. cruenta*, and has come to an opinion that it is highly improbable that the *Magasella* is an immature form; in fact there seems to be no good reason for adopting that view of the matter.

Again, in this connection, attention must be called to the fact that sometimes two *Magasellæ* will have only one "companion" species between them, as *M. flexuosa* + *M. Patagonica* versus *Terebratella dorsata*, and one *Megerlia* has two *companions*, one in the Pacific and the other in the Atlantic.

There are also some whose "companions" are unknown, or which may be without companions, as *Megerlia truncata* in the Mediterranean (a sure case) and *Magasella cumingi* in New Zealand. Both of these are such remarkable forms that it is almost

[1] *W. cranium* has been erroneously accredited to Japan.

unreasonable to treat them as if possibly immature. In fact, in regard to all the better known species of *Magasella*, those who have studied them most will be the last to admit that they are anything but mature organisms, and, by analogy, it is natural to suppose that other species less known, but presenting equal marks of maturity, are adult also.

3d. In relation to the progressive development. Of course this is practically the test of the whole question, but it may be fairly claimed that it is a test which must be applied to each individual species before the question can be considered settled. Data are few and far between on this branch of the subject. Embryological material to a considerable amount is available, but mostly relating to the species with short apophyses, or belonging to other families. Morse has shown that the loop of *Terebratulina* begins as two spikes at the cardinal margin, and the two spikes increase in length, and finally coalesce in the median line. I have observed the same thing in *Terebratula cubensis*. It is self-evident that the loop of *Waldheimia*, when adult, is merely an extension and reflection of the ideal loop of *Terebratula*, and the inference therefrom would be that its development progresses in the same way. This opinion I am, at present, inclined to adopt. In the section *Magasinæ*, where all the species have the loop supplied with an additional support in the form of a septum, a different state of things is to be found. The septum is the first part of the skeleton to make its appearance.

In *Terebratella transversa* (*caurina*, Gld.) the youngest specimens, a twentieth of an inch in diameter, showed a septum bifurcate at top and notched on the anterior edge. The anterior part of the loop is completed or nearly so, before the lower longitudinal processes are complete from the hinge to the septum. In *Magasella aleutica* the fry has a strong septum, entire and not bifurcate, before any of the remainder of the loop is developed. In *Megerlia Jeffreysi* the youngest specimens I have seen ($\frac{1}{10}$ of an inch in diameter) have the loop well developed, and (whether this is an abnormal feature or not, I am not prepared to say) laterally compressed so that the longitudinal parts of the loop are proportionally closer together (in most cases) than in larger specimens, and the septum is proportionally stronger and larger. In a large proportion of the well-grown specimens of this species, there seems to be a tendency for the septum and other delicate portions of the

ome abortive, but this I shall further discuss later. *magasellæ* the septum is the strongest and most permat of the skeleton.

Terebratella spitzbergensis we have a species which seems to e just stopped short of being a *Magasella*, and *Wald. Davidson-* Sea., seems to have a tendency in the same direction, while tr eptum of *Wald. septigera* only needs a pair of transpr ses to make it a *Terebratella*.

I have not seen very young specimens of *Laqueus californicus;* youngest *Terebratella frontalis* which I have seen agree in the lopment of septu with *T. transversa*, Sby. seems, therefo rly development of some of the panion" spec compar with the idea of their young s agreeing wit lla. we assume that what is true for two species of *Terebr* s also true for the rest, six species of the seven *Magasellæ* kn to have "companions," will have been taken out of the doul ategory. I feel sufficiently certain that *M. aleutica*, on geo hical grounds, cannot possibly be the young of *Laqueus californicus*.

There are then remaining one species of *Magasella* and two of *Megerlia*, which have *Waldheimia* "companions." Of the younger stages of *Waldheimia* we have yet no positive information.

Mr. Friele in his paper previously referred to, and which I know by the plates only, as it is in the Norwegian language, which I have not attempted to translate, appears to have primarily assumed that the *Megerliæ* were the young of *Waldheimia cranium*, because of their external resemblance and co-ordinate distribution as far as known to him. But on the examination of a good series of young *Megerlia* he found a state of things which seemed to confirm his first assumption.

Mr. Friele found the smaller specimens conforming to the general type of *Megerlia*. Those with a pronounced septum he referred to *W. septigera*, but my own impression is that these merely exhibited not unusual individual peculiarities. To me, in examining the specimens, the transition from the one to the other, as regards the septum, seemed very gradual. He found larger specimens, in which the upper processes connecting the reflexed portion of the loop with the longitudinal bands of the loop, were abortive. In this case the loop remaining was generically that of *Terebratella*. In others, again, the septum had ceased to be con-

nected with the transverse processes, and the latter in some cases had become disconnected from one another. In this stage only the remnants of the transverse processes remained to distinguish the loop from that of a *Waldheimia*. Hence he very naturally concluded that he had before him the stages of development of a *Waldheimia*, which must necessarily be either *cranium* or *septigera*, no other species being known from that region. The result was his paper. I am far from denying that this may possibly be the case. At any rate, Mr. Friele is entitled to great credit for calling attention to these very interesting facts.

Thanks to his kindness, I have been enabled to examine a series of nineteen specimens of *Megerlia* of different ages, which, with a number in my own collection from the northwest coast, enabled me to make a pretty thorough study of them, and incidentally to confirm the general accuracy of his rather formal, but still characteristic figures.

It seems to me, however, that another hypothesis will explain them, if not equally well, yet in greater harmony with the analogies of the case, and, taking the geographical distribution of *Megerlia Jeffreysi* into account, with greater probability of accuracy.

In the first place it is to be noted that the specimens offered to me an absolute gap between the long characteristic loop of *W. cranium* and the broad, elevated, rather short loop of the *Megerlia*. Even in the absence of the missing parts the loop was totally unlike that of *W. cranium*,[1] and if adult would as a *Waldheimia* be specifically distinct from *W. cranium*. Secondly, all the specimens showed a remarkable weakness and tenuity of the loop even where complete; it seemed as if the abortion of part of the loop was caused by an absence of lime; or as if the specimens, growing rapidly, and necessarily being obliged to dissolve the loop and redeposit it on a larger scale (a process constantly going on), had been unable to make the latter part of the process keep pace with the former. There was nothing to indicate that the loop was not rather an unfinished *Megerlia* than one in a process of metamorphosis. Some Alaska specimens in the National Museum are much larger and stouter in every respect, than the largest of the supposed metamorphic specimens, and also quite equal to the

[1] Except a few specimens, which differed from the rest, and were undoubted young (but not smallest) specimens of *W. cranium*.

smallest typical *W. cranium*, but they show no degradation of the *Megerlia* type of loop.

I have examined this subject in a good deal of detail, because I believe that in it lies the key to some important generalizations. Certainly if one may have transformations including three now accepted sections or genera in the life of one individual, it will necessitate some changes in our systematic arrangements. I do not think we have in this case, yet it is none the less possible, and would not be the first instance among invertebrates.

ON THE CAMBARI OF NORTHERN INDIANA.

BY WILL F. BUNDY.

Accompanying the collection of fishes made by Messrs. Cook and Levette, a report on which has been recently published in the Proceedings of the Academy, was a small collection of crawfishes. They were forwarded to me for determination by Professor Jordan.

The following are the species and localities:—

Cambarus immunis, Hagen, Long Lake, Kendallville, Ind.

Not distinguishable from specimens from Central Illinois. The young have lateral thoracic spines.

C. obesus, Hagen, Long Lake, Kendallville, Ind.

A few young females were found in the collection from this locality. The most common species in the West. A female caught in the mouth of a tile ditch at Mechanicsburg, Ind., on New Year's day, 1875, had her abdominal legs loaded with eggs nearly ready to hatch.

C. virilis, Hagen, Long Lake, Kendallville, Ind.

A few individuals apparently belong to this species, but the cephalothorax is but slightly depressed, and nearly smooth above. The inner ramus of first abdominal leg of male is not transversely flattened, and the hands and fingers are less tuberculate.

C. propinquus, Girard, Elkhart River, Rome City, Ind.
C. virilis, Hagen, Elkhart River, Rome City, Ind.
C. propinquus, Gir., Deep Lake, Northern Indiana. Exact locality not given.

The largest of this species I have ever seen measured $7\frac{1}{2}$ decimeters from tip of rostrum to that of telson. Two females present unusual variations. In one a second annulus appears between the third thoracic legs, somewhat similar in shape, but smaller in size than the normal organ. Another has hooks developed on the third thoracic legs, precisely as in males of the first form. There is also in these craw-fishes a tendency manifested toward multiplication of the lateral thoracic spines, there being in some individuals two, and in others three of these on each side.

A considerable number of this species, from an unknown locality, differ in having wider, more gaping hands, thicker at the base, as in *C. placidus*.

C. sloanii, Bundy, Bulletin No. 1, Mus. Ill. Nat. Hist., 1876, page 24.

Rostrum wide, excavated, margins nearly parallel, straight, or nearly so, acumen triangular, acute, toothed at base; cephalic carinæ short, near margin in front; antennæ shorter than body; laminæ longer than rostrum, moderately wide, external margin curved, swollen, apical tooth long, acute; epistoma wider than long, excavated narrower in front, emarginate; maxillipedes hairy on inner faces, naked below; cephalothorax subovoid, dorsum depressed, carapace finely granulated; lateral spines acute; anterior border of cephalothorax distinctly angulated; areola wide, posterior spatium wider than anterior; chelæ short, conical, wide, swollen toward base, nearly smooth below, finely granulated above, inner margin provided with two rows of inconspicuous teeth; outer finger wide at base, nearly straight, furrowed above on outer and inner margins, punctate above and below, inner margin with a row of small tubercles; inner finger curved, inner and outer margins tuberculate or serrate, more punctate above than below, incurved tips of both fingers brown, horny; third joint of third pair of thoracic legs hooked; first abdominal legs of male bifid, parts of nearly equal length, flattened, outer one nearly straight, apex directed outward; inner part slightly recurved, separating from outer part, and ending with acute points turned inward; tubercles at inner basal angle small, legs when folded under thorax reach to coxæ of second thoracic legs.

In the second form male, the chelæ are smaller and shorter, hooks on third legs smaller, first abdominal legs articulated between node and base, tips swollen, not brown horny.

The annulus of female has the anterior border scarcely separated from fourth venter, posterior border elevated, posterior angle prominent, bituberculate, the tubercles encroaching on fossa, lateral angles acute.

This species is very similar to *C. obscurus*, but on comparing it with types of this species I find the following points of difference: The rostrum is somewhat wider and more punctate above, the areola is wider, the fingers less gaping at base, the branches of first abdominal legs are round and slender in *C. obscurus*, and straight, while in *C. sloanii* they are flattened, and bent outward

and backward. The annulus of female is also decidedly different in the two species. In *C. obscurus* it is divided by a cruciform furrow into four tubercles, of which the anterior pair are largest.

Length of largest male I have seen, 3½ inches. This species inhabits streams in Southern Indiana and Kentucky. Dr. Sloan, who has studied its habits in its native streams, says of it: "I think his habit of burrowing is peculiar. He commences on the bank of the stream, burrows below the bed, and has an opening two or more feet out in the stream, where he sits watching for anything that may turn up, with a safe retreat. He can only be caught in that position by thrusting the net deep in the mud, so as to cut off his retreat."

Cambarus spinosus, Bundy, sp. nov.

Rostrum quadrangular, long, excavated, smooth above, toothed at apex; margins parallel, curved; acumen long, slender; cephalothorax depressed, punctate above, granulated on sides; lateral spines long, acute; cephalic carinæ parallel, black acute teeth in front; areola present; transverse suture not sinuous; antennæ slender, very long, reaching beyond tip of telson; laminæ as long as rostrum, narrow, tapering toward long, sharp, outward-directed apical teeth; long acute tooth at base; external margin incurved; epistoma wide, emarginate in front; maxillipedes hairy within, naked below; chelæ large, thick at base, smooth below, punctate above, inner margin finely serrate; fingers slender, curved, slightly gaping, costate above, smooth below, tuberculate and hairy on contiguous margins, of equal length, banded with black on distal half; outer margin of outer finger with a black stripe reaching on hand to carpus; two or three black spots on hand at base of movable finger; carpus with a sharp curved spine on inner margin, one on superior and two on inferior front margin; two rows of teeth on lower border of brachium, outer row with only two teeth; third joints of third pair of legs of male hooked; first pair of abdominal legs of male strongly bifid, tips of equal length, very slender, straight, separating at node; anterior margin with a tooth or projecting angle about midway from base to extremities; apical forming a very obtuse angle with basal half.

The second form male has hooks on third legs smaller, first abdominal legs longer, external part longer than internal, and slightly recurved, both tips much thicker, no tooth on anterior

margin, articulated below node and narrower at base. The female has smaller, narrower hands, straighter fingers, not gaping at base. The annulus is directed obliquely backward, transversely elliptical, a large tubercle on posterior angle and two smaller ones in front separated by a furrow continuous with nearly straight, well-defined fossa.

The longest male I have ever seen measured 3¾ inches from rostrum to tip of telson. The length of areola is contained twice in the distance from transverse suture to base of apical teeth of rostrum, thus giving the animal a peculiarly short-waisted appearance.

I have seen nineteen specimens of *C. spinosus*, of which seven were second form males and eleven females.

Habitat.—Etowah, Oostanaula and Coosa Rivers, in the vicinity of Rome, Georgia, where it is extremely abundant, in company with *C. extraneus*. From the collection of Prof. D. S. Jordan.

SYNOPSIS OF THE FISHES OF LAKE NICARAGUA.

BY THEODORE GILL, M.D., AND J. F. BRANSFORD, M.D., U. S. N.

During the spring of 1876, Dr. Bransford devoted some attention to the fishes of Lake Nicaragua while engaged in official duties under instructions from the Secretary of the Navy. The result of his labors was a collection of twenty-one species, of which seven are new to science, and several others have been for the first time definitively added to the fauna. The following article is an enumeration of the species collected as well as those otherwise known as inhabitants of the lake. The responsibility of the determination of the species rests chiefly with Dr. Gill.

Lake Nicaragua is distant from the Atlantic Ocean, at its nearest point, some sixty-five miles in an air line; while in the neighborhood of Rivas it approaches within ten miles of the Pacific. It extends in a northwest direction from its outlet at San Carlos, about a hundred and ten miles, with a maximum width of forty. A depth of 125 feet was obtained by Com'dr Lull's survey.

Except in the valley of the San Juan, the land between the lake and the Atlantic is higher and rougher than between it and the Pacific Ocean. Mean high water in the lake is above high tide in the Pacific—103.14 feet; and above mean tide in either ocean 107.63 feet. The lowest summit elevation on the west side is 43.78 feet above mean high water in the lake. This is about five miles from the lake, on the Rio Lajas route. A surface of eight thousand square miles is drained into this basin, which discharges at a minimum in the dry season 113.90 cubic feet per second, through its only outlet the San Juan River. The river is 119 miles long, and has five series of sharp rapids. The lake furnishes the inhabitants of its shores with water excellent for drinking. It is stocked with fish of great variety, from the little *Chirostoma* up to the shark and sawfish.

Most of the fish are excellent for table use. They are usually taken with a cast net, frequently at night, or with a hook and line. The sardines, as they are called, the *Chirostomæ* and *Pœciliæ*, are taken in weirs made of the branches of trees; and sometimes girls sitting on the rocky shore scoop them in with

twigs as the swell throws them into the pools and passages among the rocks. Squier thus describes the fisheries in the neighboring lake of Managua:[1] "At one point bushes were planted in the lake, like fish-weirs, between which women were stationed with scoop-nets, wherewith they laded out myriads of little silvery fishes, from the size of a large needle to that of a shrimp, which they threw into kettle-shaped holes, scooped in the sand, where, in the evening light, leaping up in their dying throes, they looked like a simmering mass of molten silver. These little fish are called sardinas by the natives, and are cooked in omelets, constituting a very excellent dish." "The first travellers in Nicaragua mention this novel fishery as then practised by the aborigines, and it has remained unchanged to the present hour."

Crabs are abundant along the banks of the lake; and turtles come ashore in great numbers, at certain seasons, to deposit their eggs.

Six years after the discovery of Nicaragua by Gil Gonzolez de Aviola, the old Spanish Chronicler Oviedo resided for some time in this region, and a few years later wrote a most valuable account of the country, its inhabitants, and productions. The following is a somewhat free translation of extracts relating to fish from his work:—

"There are in this lake (or these lakes, if you think there are several) many and good fish. But I believe it to be one single lake, and there is a good reason for it, which is that it contains very large sea fish, and from the sea they come into it, such as sharks and many alligators and cockatrices. And what confirms and affirms my belief that it is only one lake and in communication with the sea, is that in the year 1529 I found on the coast of this lake, lying on the beach, in the Province of Nicaragua, a dead fish that the waters must have thrown out, and which no man ever saw or caught but in the sea; it is called the sword fish, the one that carries a high snout at the extremity of the upper jaw; that ferocious sword full of sharp-edged teeth (on both edges) closely spaced. And this one I found dead, out of the lake, must have come into it by said outlet, and, although over 12 feet long, it was small, because the sword was small, not more than one palm and three fingers long, and not wider at the root, the widest part,

[1] Squier's Nicaragua, v. I, p. 412.

than two fingers. There is a great variety of fish, and the water is good and healthy, not very light nor heavy." (Vol. iv. page 63.)

"The common food of the Indians, and one they are very fond of, is the river and sea fish; they are very skilful in fishing and in the artifices they use for the purpose. And as some use fishing rods in Spain, the Indians in the same way fish with long and flexible poles well adapted for the purpose, and with line and bows, and more commonly with well-made cotton nets; and also with inclosures and partitions built in the shape of palisades, and from their canoes or boats. And they also employ a certain herb called *baygua*, which, thrown in the water, intoxicates the fish and after a short time they come to the surface lying on their backs asleep or stunned; and the people take them with their hands in large quantities. This baygua is similar to bexuco."

"But besides the fish thus taken from the rivers, they catch large quantities of them in the manner I stated hereinbefore. And it is my belief that these fishes from this country are healthier than those from Spain, because they contain less phlegm, but they are inferior in taste, though here are some very good; such as small and large *lisas*, *jureles*, *bemujuelas*, *mojarras*, *guabinas*, *palometas bihabacas*, *sávalos*, *robalos*, *parquetas*, *caçones*, *sardinetus*, *cornudas*, *pulpos*, *tollos*, *corbinitas*, *agujas*, *linguados*, *açedias*, *salmonades* (I do not mean salmons), *hortias* (oysters), *almejas* (clams), and shell-fish of many kinds; *langostas* (lobsters), *cancrejos* (crabs), *jaybos*, *camurones* (shrimp), *rajos*, many and in some places very large; *anguilas* (eels). *morenas* (murænas) numerous and very large; *tiburones* (sharks), *lobos marinos* (sea lion), etc." (Vol. i. p. 424.)

"They fish with poles, in imitation of the fishing rod used in Spain, and with lines. I say they learned this way of fishing from the Christians, because the Indians had no fish-hooks. Leaving out these two ways of fishing from those I have mentioned, they used to fish constantly in other manners, and also with *judrias* and with a kind of trap, in the rivers." (Vol. i. p. 425.)

The worthy chronicler must not be judged too harshly for his assumptions respecting the communicability between the sea and lake, because of the presence of sawfish and other marine types. In our days naturalists have based hypotheses and classifications upon even less data and in spite of known facts.

The earliest of the historians of Nicaragua was also the most full and satisfactory in his account of its fishes. Later travellers

have not added materially to the ichthyography of the country, and the allusions to the fishes made by Belt, Stout, Boyle, etc., it is unnecessary to recapitulate; they have chiefly adverted to the presence of sharks in the lake; the existence of the sawfish has even by Squier been regarded as apocryphal.

Almost all of our knowledge of the fish fauna of the lake has in fact been gained within the last twelve or thirteen years. With the exception of vague allusions to the fishes referred to, nothing had been published respecting them till the year 1864.

In 1864, in the fifth volume of the "Catalogue of the Fishes in the British Museum" (page 125), Dr. A. Günther described a species of Siluria under the name *Pimelodus nicaraguensis* (= *Rhamdia nicaraguensis*) presented by Capt. J. M. Dow.

In 1864, also, in a "Report of a Collection of Fishes made by Messrs. Dow, Godman, and Salvin, in Guatemala" (Proc. Zool. Soc., London, for 1864, pp. 144–154), Dr. Günther introduced four new species, viz.: ***Eleotris*** *longiceps* (= *Philypnus longiceps*), ***Heros citrinellus***, ***Heros*** *nicaraguensis*, and *Heros Dovii*, all of which had been obtained by Capt. Dow from the lake.

In 1866, in the sixth volume of the "Catalogue of the Fishes in the British Museum," Dr. Günther made known two species of Cyprinodonts, viz.: *Gambusia nicaraguensis* and *Pœcilia Dovii*, both of which, like all the previously described species, were due to Capt. Dow.

Finally, in 1868, in "An Account of the Fishes of the States of Central America, based on collections made by Capt. J. M. Dow, J. Godman, Esq., and O. Salvin, Esq." (Trans. Zool. Soc. London, v. 6, pp. 377–494, pl. 63–87), Dr. Günther introduced still another new species of *Heros*—*Heros longimanus*.

In the same memoir (p. 405) Dr. Günther also gave a full list of the fishes so far received from the lake, which then numbered nine species, and contrasted them with those from other hydrographic basins, viz.:—

"E. *Lake of Nicaragua.*—Also the fishes of this lake are, with two exceptions, peculiar; like Lake Managua, it appears to have been part of a marine channel.

Eleotris longiceps.	*Heros labiatus* (Lake of Managua)
Heros longimanus.	*Pimelodus nicaraguensis.*
—— *citrinellus.*	*Gambusia nicaraguensis.*
——*dovii.*	*Pœcilia dovii* (in common with
—— *nicaraguensis.*	Lake Amatitlan)."

The element of especial interest in connection with the ichthyic fauna of the lake, is the association of forms that we are in the habit of regarding as characteristically marine with those that are at least as exclusively fresh-water types. Thus, with the species of Cichlids and Characinids, of which no representatives have been found in marine waters, we have a species of *Megalops*, a shark, and a sawfish. The association of the Plagiostomes in fresh water is not, however, unique. As has long been known, a similar instance of combination occurs in the Philippine Islands. "Near Manila," says Mr. W. W. Wood,[1] "is the Laguna de Baij, a large sheet of water some ninety miles in circumference, divided by an island and two peninsulas, from which it is often spoken of as the lakes. This lagoon receives the waters of the small rivers of the provinces of the Laguna and Morong, and its only outlet is the river Pasig, which flows with the bay between the military city and suburbs of Manila." "The water of the lake is quite fresh, and, after settling, perfectly potable." In this lake are found a sawfish, which, according to A. B. Meyer,[2] is specifically identical with the *Pristis Perotettii* of the sea, and a shark which has not been specifically identified, but which is said to be "a small species of dog-fish, and quite harmless." It is also known to naturalists that sharks frequently ascend to a considerable distance up rivers, and that in large rivers, especially several in South America, species of rays, not known to occur elsewhere, are found.

The *Megalops* has not hitherto been known to occur in bodies of fresh water so isolated from the sea as is Lake Nicaragua.

These instances, supplemented as they are by many others, are sufficient to convey a caution against too extensive generalization of the physiographical conditions hinted at by fossil remains of aquatic types.

The why and wherefore of such combinations of species are not entirely apparent. They may have resulted (1) from the intrusion of the salt-water types into the fresh waters, or (2) from the detention and survival of the salt-water fishes in inlets of the sea that have become isolated and gradually become fresh-water lakes. On the whole, it appears more probable that the latter is the case. By the uplift of the land, an inlet of the Pacific Ocean might have been shut off from communication from

[1] Nature, xiii. p. 107, 1875.

[2] Nature, xiii. p. 167, 1875.

the ocean, and the character of the water would be soon changed by the copious showers of that tropical country. The shark, sawfish, megalops, and other species mostly found in the sea, had, however, time to accommodate themselves to the altered conditions, and in this connection it must be remembered too, that most of the types in question are known to voluntarily ascend high up streams and even into fresh water. The numerous rapids of the river discharging from the lake discourage, however, the idea that the species enumerated have voluntarily ascended that river and entered the lake. The concurrence of the fresh-water fishes with the others and their entrance into the lake from the surrounding streams would be merely a question of time.

With these remarks we close, and preface the descriptive portion with a list of the species enumerated.

GOBIIDÆ.

Philypnus longiceps.

CICHLIDÆ.

Heros rostratus.
longimanus.
labiatus.
citrinellus.
basilaris.
Dovii.
nicaraguensis.
balteatus.
centrarchus.

Neëtroplus nicaraguensis.

ATHERINIDÆ.

Chirostoma guatamalensis.

CYPRINODONTIDÆ.

Gambusia nicaraguensis.
Pœcilia Dovii.

CLUPEIDÆ.

Opisthonema libertatis.

ELOPIDÆ.

Megalops ———.

CHARACINIDÆ.

Chalcinopsis dentex.
Bramocharax Bransfordii.

SILURIDÆ.

Rhamdia nicaraguensis.

PRISTIDÆ.

Pristis antiquorum ?

GALEORHINIDÆ.

Eulamia nicaraguensis.

GOBIIDÆ.

Philypnus longiceps.

Eleotris longiceps, Gthr., Proc. Zool. Soc. London for 1864, p. 151.

——— ——— Gthr., Trans. Zool. Soc. London, vol. vi. p. 440, 1868.

Two specimens were obtained, agreeing well with Günther's description of the species in question.

CICHLIDÆ.

Heros rostratus.

The form is that of the *Helleri* type. The back declines rather rapidly to the tail, and in front of the dorsal is slightly gibbous.

The height is contained two and one-third times in the extra-caudal length. The caudal peduncle is one-third higher at its base than long. Its greatest height bears to its length the ratio of 10 to 8. The head is acutely pointed, and the snout above, rectilinear. The length of the snout exceeds half that of the head. The inter-orbital area is nearly flat. The preoperculum and cheeks are very oblique. The buccal scales are in six rows. The jaws are normally developed. The superior maxillary terminates at a vertical a little nearer the eye than the snout, and the articulation of the lower jaw is also notably in advance of the eye. The lips are moderately developed, and the lower ones separated by a broad frænum at the middle.

The dorsal fin is well developed; the anterior spines are rapidly graduated, the rest subequal; the soft rays, when bent back, extend a little beyond the basal third of the caudal. The anal fin commences under about the twelfth dorsal spine; its first four spines rapidly increase, and its last two moderately; the soft part, when bent back, extends a little beyond the basal fourth of the caudal. The caudal enters four and one-third times in the extreme length, and is subtruncate, but slightly emarginated in the middle. The pectoral fins are well developed, and extend about as far backwards as the first anal rays. The ventral fins have filamentary rays which extend backward to the last anal spine.

The color is a bronzed olive indistinctly crossed, at least in the young, by two bands, one under the dorsal, and the other below its last rays; later, these fade out more or less, leaving, of the first, only a rather indistinct dorsal saddle under the median spines, and of the second, a distinct black spot below the lateral line. A black spot also exists at the base of the caudal fin, mostly above the lateral line. The breast and lower surface of the head bronzed or blackish towards maturity.

The dorsal at its spinous part is dusky and immaculate, but in its soft portion diversified by dusky areas in three or five rows, separated by narrow light interspaces. The anal is more nearly uniform, but still has a few light spots. The caudal is reticulated by bright interspaces on a dusky ground. The pectorals are spotless. The ventrals dusky.

This species is quite characteristic in the extension of the rostrum, and is thus readily distinguished from at least any of the Nicaraguan species, if not from any yet made known. It is apparently most nearly related to the *Heros affinis* (Günther), of Lake Peter. Eleven specimens of various sizes were obtained by Dr. Bransford.

Heros longimanus.

Heros longimanus, Gthr., Trans. Zool. Soc. London, v. VI. p. 453, pl. 72, fig. 2, 1868.

But one half-grown specimen was obtained by Dr. Bransford.

Heros labiatus.

Heros labiatus, Gthr., Proc. Zool. Soc. London, for 1864, p. 27, pl. 4, fig. 1, 1864.

Heros labiatus, Gthr., Trans. Zool. Soc. London, v. VI. p. 456, 1868.

Heros citrinellus.

Heros citrinellus, Gthr., Proc. Zool. Soc. London, for 1864, p. 153, 1864.

Heros citrinellus, Gthr., Trans. Zool. Soc. London, v. VI. p. 459, pl. 71, fig. 1, 1868.

Four specimens were obtained, which apparently belong to this species, although none exactly agree with the description or figure published by Dr. Günther.

Heros basilaris.

The form is that of the *Margaritifer* and *Citrinellus* type. The back declines moderately to the tail, and is regularly decurved in front of the dorsal fin; the height is contained two and one-third times in the extra-caudal length; the caudal peduncle is not

much higher at its base than long, and it decreases very gradually to the fin; the head is normal, and the snout above convex and blunt in front, the length of the snout is little more than a third the length of the head; the interorbital area is slightly raised; the preoperculum is nearly vertical; the buccal scales are in four rows; the jaws are normally developed; the supra-maxillary terminates at a vertical, very little in advance of the orbit; the lips are moderately developed, and are free all around; the teeth of the outer row are of rather large size; the dorsal fin is moderately developed; the anterior spines are normally graduated, the rest subequal; the soft rays when bent back extend nearly to the terminal third of the caudal; the anal fin commences under the thirteenth dorsal spine, its first three spines are rapidly, and the succeeding moderately, graduated; the largest soft rays, when bent back, reach the second third of the caudal; the caudal enters four and a third or four and a half times in the extreme length, and its margin is convex-truncate; the pectoral fin extends to the vertical of the third and the ventral fin to that of the fourth or fifth anal spine.

D. xvi. 12. A. vii. 8.

The color is bronzed-olive, with (in the young, at least) seven bands; in the fourth band is developed a distinct blackish spot just under the lateral line, and on the base of the caudal fin, above the lateral line, is another, but smaller, blackish spot; the dorsal and anal fins are dusky, but the soft parts much darker at the base than on the rest of their fins and surface; the caudal fin is also much darker at its basal third than behind; the pectoral and ventral fins are dusky and uniform, save that the filamentary rays of the ventrals are darker.

The species is quite nearly related to a number of species, and, among the Nicaraguan ones, next to the *Heros longimanus*, but its combination of characters sufficiently differentiates it as a distinct species from any previously well characterized. It is one of the most abundant species of Lake Nicaragua.

Heros dovii.

Heros dovii, Gthr., Proc. Zool. Soc. London, for 1864, p. 154, 1864.

Heros dovii, Gthr., Trans. Zool. Soc. London, v. VI., p. 461, pl. 73, fig. 4, 1868.

No specimens were obtained by Dr. Bransford.

Heros nicaraguensis.

Heros nicaraguensis, Gthr., Proc. Zool. Soc. London, for 1864, p. 153, 1864.

Heros nicaraguensis, Gthr., Trans. Zool. Soc. London, v. VI., p. 465, pl. 77, fig. 1, 1868.

No specimens are in Dr. Bransford's collection.

Heros balteatus.

The form is that of the *Godmanni* type; the back declines rather slowly, and in a gentle curve to the tail, and in front of the dorsal is boldly decurved to the forehead; the height is contained rather more than two and a half times in the extra-caudal length; the caudal peduncle is little higher than long, and gradually diminishes to the tail; the head is abbreviated and the snout convex above and almost sub-truncated in front; the length of the snout enters two and a half times in that of the head; the inter-orbital area is flat; the preoperculum mostly vertical, but convexly protuberant at the angle; the buccal scales are in five rows; the jaws are normally developed; the supra-maxillary terminates at a vertical in front of the orbit; the lower lip is indicated by an obsolete fold wanting towards the symphysis; the teeth in the outer row are moderately enlarged; the dorsal fin is slightly developed; the anterior spines are rather slowly graduated, and the rest subequal; the longest soft rays, when bent back, extend to the terminal half of the caudal; the anal fin commences under about the fourteenth dorsal spine; the spines at first rapidly and then gradually increase in length backwards; the longest soft rays, when bent back, reach the second third of the caudal fin; the caudal fin enters four and a third times in the extreme length, and is slightly emarginated; the pectoral fins reach backwards to the vertical of the third anal spine, and the filamentary rays of the ventral fins extend to the fourth or fifth anal spine.

D. xviii. 10. A. vii. 7.

The color (in spirits) is yellowish-orange; a rather broad black band extends from the post-ocular region across the operculum and shoulder, along the flanks to the spot at the base of the caudal fin. The back in front of the dorsal has also a blackish spot, and under the base of the dorsal fin are more or less defined dark areas or spots; the dorsal fin is dusky and immaculate, as are also the anal and caudal; the pectoral fins are yellowish at the base and dusky beyond, and the ventral have the outer rays dusky (but

with the edge of the external lighter) and the inner yellowish; the branchiostegal membrane below is orange or yellowish, and the breast slate-colored.

This is also an abundant and characteristic species. Of the previously known Nicaraguan species it seems to most resemble the *Heros nicaraguensis*, but is so decidedly distinct as to need no special comparison.

Heros centrarchus.

The form is of the *Multispinosus* type; the parts above and below the longitudinal axis are nearly equally balanced; the back declines moderately in a curve towards the tail and in front of the dorsal is slightly, but regularly decurved towards the forehead; the height is contained twice in the extra-caudal length; the caudal peduncle is very short, its height at the root being twice as great as it is long, and it comparatively rapidly narrows to the caudal; the head has the forehead slightly gibbous, and the snout is rectilinear and pointed in front; the length of the snout is little more than a fourth of that of the head; the interorbital area is slightly raised; the preoperculum is nearly vertical and at the angle boldly rounded; the buccal scales are in five rows; the jaws are normally developed; the supramaxillary terminates at a vertical about a pupil's length in advance of the eye; the lips are moderately developed and the lower is interrupted in front; the teeth of the outer row are rather strong; the dorsal fin is moderately developed; the dorsal spines increase in a regular, bold curve from the first to the sixth, and the following are nearly equal; the longest rays bent backwards extend for the length of the basal half of the caudal; the anal fin is very long and commences under the ninth dorsal spine; the spinous portion is not much less than three times longer than the soft; the first three spines are rapidly graduated and the following ones nearly equal; the longest soft rays reach backward to the terminal half of the caudal; the caudal fin forms a quarter of the extreme length, its angles are round and the posterior margin slightly emarginated; the pectoral fin extends backwards nearly to the vertical of the fifth or sixth anal spine; the ventral fins also reach to nearly the same point.

D. xvi. + 8; A. x. + 9.

The color is bronze-olive, with seven indistinct cross-bands; at the base of the tail is a faint spot chiefly above the lateral line; the fins are dusky and emaculate.

The species is related to the *Heros multispinosus*, but is distinguished sufficiently by the characters specified in the description. The specimen preserved at least is entirely destitute of the distinct longitudinal band which characterizes the *H. multispinosus*, and is also distinguished by a slight gibbosity above the orbit which contrasts with the straight profile of the older species.

But one specimen was procured. Both in physiognomy and in the number of the anal spines it resembles the genus *Centrarchus* of North America, and, hence, the name is very appropriate, inasmuch as it serves to recall this resemblance as well as to indicate the great number of spines. The group of which it is a representative may receive the subgeneric name of *Archocentrus*.

Neëtroplus nicaraguensis.

The form is almost entirely that of *Neëtroplus nematopus;* the back declines equally slowly backwards, but in front of the dorsal falls in a more regular convex line to the forehead; the height equals two-fifths of the extra-caudal length; the caudal peduncle is slender, and its length equals the height; the head is short, and the snout convex forwards and subtruncated in front; the length (or depth) of the snout equals nearly half that of the head; the interorbital area is convex; the preoperculum moderately oblique; the supra-maxillaries terminate at a vertical about a pupil's length in advance of the orbits; the lips are moderately developed, the lower interrupted by a broad isthmus in front; the dorsal spines increase in a bold curve from the first to the fifth and the rest are subequal; the soft rays, when bent back, reach nearly to the terminal half of the caudal; the anal fin commences about under the fourteenth dorsal spine; the first three spines rapidly increase, the succeeding slower; the longest rays reach to the second third of the caudal fin; the caudal fin forms about a fourth of the extreme length and its posterior margin is truncated; the pectoral fin extends to about a vertical with the anus; the ventral fin to about the third or fourth anal spine, the filament of the external ray being moderately produced.

D. xviii. + 11; A. vii. + 7.

The color is olive-brown, and almost uniform. The fins are also uniform save that, perhaps, the soft portion of the dorsal and anal are darker at the base.

The species is very closely related to the type and hitherto only known species of the genus *Neëtroplus* (*N. nematopus*), but is

distinguished by the simple convex forehead, and the more truncated snout, the truncated caudal, the less elongated ventral filaments, and the uniform color of the operculum. Three specimens were obtained.

ATHERINIDÆ.

Chirostoma guatemalensis.

Atherinichthys guatemalensis, Gthr., Proc. Zool. Soc. London, for 1864, p. 151, 1864.
Gthr., Trans. Zool. Soc. London, v. VI., p. 443, 1868.

Nine specimens were obtained which doubtless belong to this species, although they do not entirely agree with the description, which, however, is too brief.

CYPRINODONTIDÆ.

Gambusia nicaraguensis.

Gambusia nicaraguensis, Gthr., Cat. Fishes B. M., v. VI., p. 336, 1866.
Gthr., Trans. Zool. Soc. London, v. VI., p. 483, pl. 82, fig. 3 (fem.), 1868.

Known only through the description and figure published by Dr. Günther.

Pœcilia Dovii.

Verified Synonymy.

Pœcilia Dovii, Gthr., Cat. Fishes B. M., v. VI., p. 344, 1866.

Possible Synonymy.

Gambusia plumbea, Troschel, Reise Mex. von Müller, v. III., p. 106.

Five specimens were obtained.

CLUPEIDÆ.

Opisthonema libertatis.

Meletta libertatis, Gthr., Proc. Zool. Soc. London, for 1866, p. 603, 1867.
Clupea libertatis, Gthr., Cat. Fishes B. M., v. VII. p. 433, 1868.
Gthr., Trans. Zool. Soc. London, v. VI., p. 487, 1868.

Two small specimens were obtained.

ELOPIDÆ.

Megalops ——.

The Megalops is a most beautiful fish, with olive-green back, and sides frosted with silver. The specimen, of which only two scales were preserved, sprang upon the deck of the river steamer while going down the Toro Rapids—the first set after leaving the lake.

re in 1873, one that weighed 62 lbs. sprang into our boat. ch, 1873, while encamped at the head of the Toro Rapids, ery evening, just before sunset, one of these magnificent fish came close under the grassy bank to play in the deep swift current. It would make its appearance, and, turning on its side, slowly sink and rise again. One evening I stood in wait with a harpoon, the blade of which, about eight inches long, was armed with four or five barbs, about an inch in length. On the fish's ach the harpoon was hurled and buried six inches in the behind its shoulder. The terrified animal rushed down m in a style that made our hands burn as the long line spun ugh. Three men were required to hold it, but in five minutes was apparently exhausted and allowed itself to be hauled up near the bank. Two Indians were sent out in a canoe to land it, but when touched, it gave a convulsive spring, tearing away and leaving chunks of flesh on each barb. The flesh of this fish is rather coarse, but much eaten by the natives. (Bransford.)

CHARACINIDÆ.

Chalcinopis dentex.

Brycon dentex, Gthr., Proc. Zool. Soc. London, for 1860, p. 240.
Chalcinopsis dentex, Gthr., Cat. Fishes B. M., v. V. p. 337, 1864.
Gthr. Trans. Zool. Soc. London, v. VI. p. 478, pl. 82, f. 2, 1864.

The height of the body is contained three and one-third times in the total length without the caudal; the length of the head is a little less than four times; the maxillary extends to a vertical with the front of the pupil of the eye; the snout is about as long as the eye; the interorbital space is convex, its width is nearly half as great again as the length of the snout; the dorsal fin has its origin nearer the base of the caudal than the extremity of the snout, and its posterior is above the anal; the free portion of the tail is considerably longer than high; the caudal fin is deeply forked; the pectoral fin extends nearly as far backwards as the base of the ventrals. The color is olive-brownish on the back, and silvery on the flanks and abdomen; the scapular arch is bordered with blackish; the dorsal fin is dusky; the anal fin forwards is also dusky towards the free margins.

Two specimens were collected, which, as will be seen from the above description, agree essentially with *Chalcinopsis dentex*, of Günther; but one of them is distinguished by a remarkable devi-

ation from the type in the development of the preopercular and buccal bones of one of the sides.

On the right side, the preopercular bone extends backwards over the interoperculum, and has an oblique posterior margin; the enlarged inferior, or buccal, suborbital bone is more than twice as long as high, and its posterior margin is oblique and parallel with that of the preoperculum; the post-orbitals are well developed and nearly contiguous. On the left side, the homologous bones present essentially the characteristics attributed to them in the figure published by Günther.

Genus BRAMOCHARAX.

Body elongated, compressed—fusiform, and with the belly, in front of the ventrals, rounded. Scales of moderate size, with entire margins, but very distinct radiating striæ on their exposed surfaces; lateral line moderately decurved and complete; head moderate, with a pointed slender snout and slightly incurved profile; sub-orbital bones well developed, and with the buccal and combined post-ocular ones subequal and enlarged; nostrils close together and separated only by membranous partition; mouth with the cleft moderately oblique and deep, extended at least below the anterior borders of the eye; teeth uni-serial on the jaws; those in intermaxillary, as well as dentary, being compressed and conical; those of the former moderate, and those of the latter enlarged, especially on each side of the symphysis; teeth of supra-maxillary extending along almost its entire edge, and small, compressed, and muticuspid or denticulate; branchial apertures ample, the branchiostegal membrane being deeply cleft and free from the isthmus; dorsal fin short and sub-median, being above the space between the ventrals and anal; anal fin moderately long, and restricted to the posterior half of the fish's length; pectorals moderate; ventrals abdominal, and inserted at nearly a head's length behind the head.

The genus thus defined, is, in brief, characterized by the physiognomy of an *Astyanax* or bream, combined with characteristics of the genus *Cynopotamus*, and technically, at least, it approaches nearest to the last-named group. Its distinctive features are found in the association of characters enumerated, especially the form, size of scale, dentition, moderately elongated anal, and position of the ventrals.

Bramocharax Bransfordii, Gill.

D. 11, A. 2 + 26, P. 16, V. 1 + 8.

The height is contained about two and three-quarters times in the length, exclusive of the caudal.

The head enters three and two-thirds times in the same length.

The eye is large, its diameter equalling a quarter of the head's length. The snout is somewhat longer than the eye, is attenuated, and projects slightly beyond the lower jaw. The superior maxillary bones are much decurved, and extend somewhat behind the centre of the eye.

SILURIDÆ.

Rhamdia nicaraguensis.

Pimelodus nicaraguensis, Gthr., Cat. Fishes B. Museum, v. V., p. 125, 1864.

No specimens were secured by Dr. Bransford.

PRISTIDÆ.

Pristis antiquorum.

A saw of the species of *Pristis* inhabiting Lake Nicaragua has been sent to the Smithsonian Institution by Dr. Flint, of Granada. It essentially agrees with those of the *Pristis antiquorum* in the collection of the Institution, although quite well marked individually. The lake-dweller may still prove to be a form differentiated specifically from its marine congener; there is, however, no sufficient reason for its determination from the saw.

GALIOSHINIDÆ.

Eulamia nicaraguensis.

The snout is short and obtusely rounded; the distance between the mouth and the extremity of the snout is considerably less than (about four-fifths of) the interval between the inner angles of the nostrils; no labial fold is superadded to the groove at the angle of the mouth; the teeth are rather larger and less numerous than usual, *e.g.*, $\frac{25}{25} = \frac{12+1+12}{12+1+12}$; the upper of these are nearly regularly triangular, scarcely notched on the posterior margin, and with both margins distinctly serrated; those in the lower have a broad two-rooted base, but narrow cusps which are very finely serrated on the margins; the first dorsal commences just behind the vertical from the inner axil of the pectoral fin,

and its vertical height about equals the snout at the line of the nostrils, and is considerably higher than long at its base; the second dorsal is somewhat larger than the anal, its base is about two-fifths as long as that of the first dorsal, while its height is about a third of that of the first; the pectoral fins are moderately developed, the greatest extent being considerably less than twice the height of the dorsal.

The shark of Lake Nicaragua cannot be identified with any of the previously-described forms, although closely related to *Eulamia Milberti* and the kindred species. The specimen described, when freshly caught, measured 6 feet 4 inches in length. The skin and jaws were preserved. Although, as indicated in the introductory remarks, it has long been known that a shark was an inhabitant of the lake, the relations of the species have been previously unknown, and the spoils obtained by Dr. Bransford are the first that have been subjected to scientific examination.

Larger specimens than that obtained might have been procured, but Dr. Bransford took the first caught. There are numerous well-authenticated cases of people having been killed by these sharks, and the natives are very careful to keep out of their way. Some six months before Dr. Bransford's arrival a man was bitten by one near the place where this specimen was taken. A great portion of one thigh and buttock was cut away, and he died from the effects. Repeated tales are told of similar incidents. Squier says: "Sharks abound in the lake. They are called tigrones from their rapacity. Instances are known of their having attacked and killed bathers within a stone's throw of the beach at Granada."[1] They are found throughout the length of the river San Juan, of sizes varying from a foot to over six feet in length. Sivers thinks that they come up the river from the sea.

[1] Squier's Nicaragua, vol. i. p. 196.

ON LAVENDULITE FROM CHILI, S. A.

BY E. GOLDSMITH.

In some of the huge blocks of cobalt ore from Chili, which were on exhibition in Fairmount Park last year, blue irregular veins of a mineral were observed; this blue mineral was supposed to be the Lavendulan of Breithaupt.

The Lavendulan was first found at Annaberg, Saxony, but only in very small quantities, insufficient for the making of a quantitative analysis. Prof. Plattner as well as Mr. Lindacker—the latter found the second locality somewhere in the Austrian Empire—agree that it is composed of the oxides of arsenic, copper, cobalt, nickel, and water.

I found in the Lavendulite from Chili the same elements, besides some impurities, as lime, oxide of iron, and insoluble matter which were impossible to separate mechanically.

It occurs in a gray rough rock which seems to be Trachyte, and it is associated with Erythrite, the latter sometimes finely crystallized. Although the lavender blue mineral seems to be, in some specimens, the most conspicuous, it is, nevertheless, on close examination found to be intimately mingled with the gray granules of Trachyte in which it is found. This circumstance makes it very tedious and difficult to separate the pure substance for analysis. The best or purest which I could obtain was but 77.58 per cent.

I noticed with the lens that the substance is an aggregation of very minute crystals, the length being in some of the thin veins equal to the thickness of the vein. Its hardness I could not determine, because the fragments separated from the rock were too small for observation. The specific gravity I did not take on account of the impurities present. Prof. Breithaupt found for the Lavendulan from Annaberg: H = 2.5 — 3. and S. G. = 3.014.

Color lavender-blue; the powder produced is paler.

The lustre is slightly resinous, almost dull; its fracture is indeterminable in the small fragments I possessed. If a fragment is held in the flame of the Bunsen burner, it fuses readily, coloring the flame green and changing the blue color of the mineral to black.

Heated in the closed tube it affords water.

On charcoal with carbonate of soda it gives copper and a strong alliaceous odor indicating arsenic.

With borax in O. F. a blue glass is obtained.

In water it seems to be insoluble.

Hydrochloric acid dissolves it easily if heated, and affords a green solution.

The following is the quantitative result of an examination of all the elements:—

$\dot{A}s$	= 36.38	per cent.
$\dot{C}u$	= 31.11	"
$\dot{C}o$	= 1.95	"
$\dot{N}i$	= 1.05	"
$\dot{H}$	= 7.09	"
$\dot{F}$	= 6.38	"
$\dot{C}a$	= 3.23	"
Insol.	= 11.61	"
	98.80	"

On subtracting the impurities from the sum found, there remained 77.58 per cent.; this is considered the quantity of pure substance contained in the mixture, which, as remarked before, could not be had any better. If we resolve the remainder to a hundred, the numbers will then stand thus:—

$\dot{A}s$	= 46.89	per cent. contains	16.30	of oxygen.	
$\dot{C}u$	= 40.10	" "	8.27	"	} = 9.08
$\dot{C}o$	= 2.51	" "	0.53	"	
$\dot{N}i$	= 1.35	" "	0.28	"	
$\dot{H}$	= 9.13	" "	8.11	"	

The oxygen ratios of

$$\dot{A}s : \dot{R} : \dot{H} = 5.4 : 3.02 : 2.7,$$

or, adopting for it 5 : 3 : 3, it will afford the formula:—

$$\dot{A}s\ (\dot{C}u,\dot{C}o,\dot{N}i)^3 + \dot{H}^3.$$

This formula would require these values:—

$\dot{A}s$ = 44.04 per cent.

Assuming only

$\dot{C}u$ = 45.61 per cent.

$\dot{H}$ = 10.30 "

The respective equivalents of the oxides of cobalt and nickel being lower than the equivalents of the oxide of copper, in the last theoretical quantities, the $\dot{C}u$ is necessarily greater. The specimens for analysis were furnished by the curators of the Academy.

MAY 1.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-one members present.

A paper entitled "Notes on the Natural History of Fort Macon, N. C., and Vicinity, No. 3," by Dr. H. C. Yarrow, was presented for publication.

MAY 8.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

A paper entitled "On the Brain of Chimæra Monstrosa," by Burt G. Wilder, was presented for publication.

On the Placenta of a Monkey.—Dr. H. C. CHAPMAN remarked that as it is comparatively rare for monkeys to breed in confinement, and as the opportunity does not often present itself of examining the placenta in these animals, a few remarks on the character of that structure in the *Macacus nemestrinus* might not be considered superfluous. The young monkey, which was born dead in the Zoological Garden, measured 13 inches from snout to tip of tail. As in the case of almost all the old world monkeys or Catarrhines, there were two placentæ, which measured in their largest diameters 3 and 3½ inches respectively, and were discoid in shape. The umbilical cord was 7½ inches in length, and contained one umbilical vein, and two umbilical arteries. Curiously enough in the South American monkeys, while there are two umbilical veins, as well as two arteries in the cord, the placenta is single.

On the Earthy Oxides of Samarskite.—Prof. J. LAWRENCE SMITH made some remarks on the anomalous properties of the earthy oxides of samarskite belonging to that class of the earths which are precipitated by a cold concentrated solution of sulphate potash, or sulphate of soda. He gave his reasons for believing that these oxides contain but little if any cerium oxide, and that there is a strong probability of the bulk of it being a new earth. He expressed these views with much caution, because more thorough investigation on larger quantities might possibly prove them to be inaccurate.

On Marbleized Iron.—Mr. WM. H. DOUGHERTY reported the results of his examination of a new article of enamelled iron-ware

called "Marbleized Iron," which had recently been extensively sold in this city for cooking and other domestic purposes.

Some of this ware having been introduced into his own household, and hearing reports of the enamel having much lead and arsenic in its composition, he had made the following experiments:—

A pint of good ordinary so-called "White Wine" vinegar was poured into a new dish of this ware, and slowly evaporated nearly to dryness—distilled water was then added, and treated with hydro-sulphuric acid—the resulting precipitate of sulphide of lead was then dissolved in nitric acid, and reprecipitated with sulphuric acid in presence of alcohol as sulphate of lead, and weighed 183 milligrammes, or over $2\frac{3}{4}$ grains, which result was further confirmed by reducing it to metallic lead with the blowpipe.

This result would indicate that the vinegar had dissolved out of the enamel enough lead to make about *three* grains of acetate of lead.

Into another dish of the same ware was put an ounce of citric acid, dissolved in a pint of distilled water, and boiled for some time, and then treated precisely as the vinegar in the first experiment, resulting in a precipitate of sulphate of lead, weighing somewhat less than that obtained by the vinegar, but showing that the citric acid had dissolved out a corresponding amount of lead from the enamel, as in the first experiment.

These two acids, acetic and citric, were used preferably as those most likely to come in contact with this ware in domestic uses—the first in vinegar, and the other (citric acid) occurring not only in the orange family, but being also present in the free state in gooseberries, currants, cherries, and in the potato and onion.

A can of tomatoes in an acid condition was digested in another dish of this ware and filtered—the filtrate treated as in the former experiments showed slight but positive evidences of the presence of lead.

Arsenic is said to be present in this enamel, but none had been found after repeated trials, both by wet and dry tests.

The stronger acids and caustic alkalies decompose this enamel. A portion of which, detached with considerable trouble, and fused with carbonate of soda in the usual way, yielded about as follows:—

Oxide of lead	. . . . .	12 per cent.
Silica	. . . . .	47 " "
Alumina, Iron, Lime, Potash, Soda	. . . . .	41 " "
		100 " "

MAY 15.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

Remarks on Gregarines.—Prof. LEIDY remarked that his recent study of the Rhizopods had led him once more to make an examination of some of the Gregarines, regarded as pertaining to a nearly related class.

The Gregarines are especially parasites of the Articulata, most of the known forms having been found in insects, crustaceans, myriapods, and annelides. Most of those observed by himself were found in vegetable and dirt feeders. They frequently occupy the alimentary canal, but in some animals occupy other organs or the perivisceral cavity. With few exceptions, the Gregarines at maturity consist of a comparatively large nucleated cell, which for convenience may be named the body cell, continuous at one pole with a small non-nucleated cell, which in like manner may be viewed as the head cell. Both cells are filled with fine globular granules, which in mass give the Gregarines a milk-white appearance. No mouth or trace of intestinal organs exists. The outer wall of the cells is a thick, structureless, contractile endosarc; and within this, in the body cell, there is often perceptible, as in *Gregarina larvata* of our common *Julus*, a well-marked longitudinally striated and apparently muscular layer.

The motions of the Gregarines consist of a kind of peristaltic action of the wall of the body cell proceeding from one to the other end.

In the Gregarines, so common in several species of our earthworms, the head cell is absent, and therefore is very properly viewed as of a different genus from the more ordinary *Gregarina* under the name of *Monocystis*. The *Monocystis agilis* is sausage-like in form, and is usually from $\frac{1}{3}$ to $\frac{3}{4}$ of a millimetre in length. In movement its contractions may commence at one end and proceed towards the opposite end, or it may commence at both ends proceeding towards the middle, or may commence in the latter position and proceed towards the ends.

From the researches of Lieberkühn and others, it appears that the Gregarines of earthworms assume a globular form and become encysted, and the granular contents are in a greater measure resolved into navicula-shaped germs, which have been named pseudonaviculæ or navicellæ or psorosperms. Lieberkühn was led to consider the amœboid perivisceral corpuscles of the earthworm, as amœba-like embryos derived from the navicellæ, but it is very doubtful whether there is any relationship whatever between the

two. Both Gregarines and navicella-cysts are met with in the intestine of our common earthworm, but the cysts are to be found most frequently and abundantly in the sperm vesicles. In the six vesicles of an earthworm Prof. Leidy had counted 1540 mature navicella-cysts, together with a number of groups of immature cysts. The mature cysts, readily visible to the naked eye, as minute pearly-white globules, by transmitted light have a peculiar pale blue hue. They measure about $\frac{1}{4}$ of a millimetre in diameter. A cyst burst open spread its navicellæ over a millimetre square, and was estimated to contain about 2500. These were quite uniform in size, and measured 0.0133 mm. long and 0.00665 broad.

E. Van Beneden has clearly traced the development of the *Gregarina* of the Lobster from Amœba-like embryos, so that it is not improbable that similar embryos may be derived from the navicellæ.

The Gregarines are usually viewed as constituting the lowest class of the Protozoa, and hence the lowest of animals. From their structure and mode of development, Prof. L. considered them as holding a higher rank than Rhizopods, and occupying a position intermediate to these and the Infusoria.

Prof. L. further stated that in a large earthworm, *Lumbricus terrestris*, from the yard of his residence, the posterior pair of sperm vesicles alone contained upwards of a thousand navicella-cysts, besides several thousand Gregarines, *Monocystis agilis*, exhibiting the varieties of condition, such as have been represented by Schmidt, Lieberkühn, and others. Many of the Gregarines were invested with motionless cilia, while other actively contracting individuals possessed no trace of these appendages. Some of the Gregarines further exhibited transition stages towards transformation into navicella-cysts. The latter differed from those previously mentioned in having but a single thin membranous layer for their wall instead of many layers.

Prof. L. added that our earthworms, which appear to be the same as the common European species, likewise appear to be infested with the same variety and kind of parasites. Among the latter he had repeatedly observed the infusorian *Anoplophrya lumbrici*, and also several different nematoids. One of these, which he had found in the sperm vesicles, appeared to be undescribed. It was certainly different from the *Dicelis filaria* found in the same organs by Dujardin. It appears nearly related with *Anguillula*, and may be regarded as such with the name of *A. melancholica*. Its characters are as follows: Body cylindrical, tapering at the ends, distinctly annulated. Head truncated, with the vertex convex, and perforated centrally by the mouth, and defined from the sides by an elevated annulus. Tail conical, and ending in a short, thick conical process. Mouth a minute round pore, unarmed; pharynx a short narrow tube; œsophagus long, cylindroid, widening posteriorly, and rather abruptly narrowed at

the anterior extremity; gizzard wider than the œsophagus, cylindrical and rounded at the extremities; intestine straight, intensely black or blackish brown. Length from 3 to 4 millimetres; thickness at middle 0.15 m. Length of œsophagus 0.5 m., of gizzard 0.125 m., thickness 0.075 m., thickness of intestine 0.05 m., length of tail from anal aperture 0.175 m. Color black, with the anterior end white. All females. Sometimes upwards of a dozen found in the sperm vesicles of a single earthworm.

MAY 22.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-three members present.

The death of Matthew Baird was announced.

On Chilomonas.—Prof. LEIDY remarked that while strolling along the sandy beach at Cape May, N. J., he observed that in a number of places, where the water of hollows had sunken away in the sand, a thin yellowish-green film colored the surface. A portion of this green matter scraped up was put in a bottle with sea water. The heavier sand subsided, and the green matter remained in suspension, giving the water an olive-green color, reminding one of the colored turbid liquor decanted from a jar of stale preserved olives. The color was suspected to be due to the presence of diatomes, but on microscopic examination it proved to be caused by multitudes of a greenish Monad, probably pertaining to the genus *Chilomonas*. The minute flagellate infusorian is discoid-oval in form, with a slight emargination laterally a short distance posterior to the fore extremity. The emargination apparently indicates the position of the mouth, and from it projected a single delicate flagellum, scarcely distinguishable. At times the little creature assumed a more circular shape, or became reniform. It moved actively forward, rolling over from one side to the other, and rapidly vibrated the flagellum. Under a high power the animal appeared transparent and colorless or faintly bluish, with two or three large balls of a yellowish-green hue, and several transparent, colorless, and well-defined globules. In size the monad ranged from the $\frac{1}{4000}$th to $\frac{1}{3400}$th of an inch in length. An average-sized individual measured 0.008 mm. long, 0.006 broad, and 0.004 thick.

On Enstatite.—Dr. GEORGE A. KÖNIG placed on record the occurrence of *Enstatite* as one of the associates of corundum in Georgia. The material came to Dr. A. E. Foote from a dealer in that State, with other specimens, showing the characteristic associations of corundum, spinel, and chlorite. At first sight the mineral appears like fibrolite, altering into damourite, so well known from corundum localities.

It occurs in tabular aggregations with eminent cleavage, parallel to the prism of 93°, to the clinopinakoid, and decidedly, but less distinct, to the base. Enstatite is *Orthorhombic*, according to Kenngott and Descloizeaux. The specimen under examination, however, is *Monoclinic*, by the pronounced cleavage parallel to the base; the form is therefore closely that of pyroxene, with the exception that in the latter mineral the plane passes through the main axis and the clinodiagonal intersects the acute angle of prism (87°), whilst in the present case this plane intersects the obtuse prismatic angle (93°). This relation was noticed on a number of cleavage fragments. In a plate parallel to the clinopinakoid (principal cleavage plane), no polarization takes place. Owing to the fibrous structure the speaker was not able to prepare an optical section parallel to the basal plane or at right angles to the main axis, and the optical constants could not be ascertained. Lustre vitreous on prismatic faces, pearly on the pinakoid. Color slightly yellowish olive-green to colorless. Chromite in small grains is noticed in the mineral. Hardness 5.5. Sp. gr. = 3.235 (20° C.).

B. B. Infusible. Manganese reaction with fluxes.

Decomposes with sulphuric acid slowly.

Composition:—

			O.
SiO_2	=	57.70	30.75
MgO	=	35.82	14.32
FeO	=	4.96	1.10
MnO	=	0.20	
Al_2O_3	=	0.91	
H_2O	=	0.78	
		100.44	

$\dot{R} : \dot{S}i = 1 : 1.994.$ RO, SiO_2.

Fe : Mg : Si : O = 1 : 12.33 : 13.84 : 41.8.

The empirical formula is, therefore:—

$$FeMg_{12}Si_{14}O_{41}.$$

MAY 29.

WM. S. VAUX, Vice-President, in the chair.

Thirty-eight members present.

On Painted Turtles.—Miss S. P. MONKS stated that our common painted turtle, *Chrysemys picta*, Herm., is distinguished from the western species, *Chrysemys oregonensis*, Harl., by its smaller size and uniform yellow plastron.

Ch. oregonensis has a dark lyriform blotch extending the length of the plastron.

About the middle of April she found, in a marsh near Cold Spring, N. Y., a *Ch. picta* about two and a half inches long which had a black mark on its plastron. The mark, each side of the central line, is irregular, about a quarter of an inch wide, and beginning at the anterior part of the anal shield extends an inch and ends on the posterior portion of the pectoral shield.

It may not be rare to find eastern turtles marked so, but she had never seen one, either smaller or larger than this specimen, among all the specimens she had examined.

On Flukes infesting Mollusks.—Prof. LEIDY remarked that our common fresh-water mollusks, especially the gastropods, were much infested with flukes. These appear to be prevalent during the latter part of the year and absent during the earlier part. Drawings were exhibited of the sporocysts and cercariæ of two species of flukes infesting *Planorbis parvus*.

The species were named and described as follows:—

MONOSTOMA (GLENOCERCARIA) LUCANICA.

Sporocyst bright orange colored, cylindroid in form, with obtusely rounded extremities. Pharynx globular, from which is suspended a long cylindrical pouch-like stomach, black in hue, extending two-thirds the length of the body. Body cavity distended with cercariæ in various stages of development. *Cercaria* white; with a compressed ovoid body emarginate behind; tail cylindro-conical, pointed, as long or longer than the body, often constricted so as to appear more or less moniliform. Eyes two, black; with an intermediate black pigment spot looking like a third eye, and a number of smaller pigment spots scattered in the vicinity of the eyes. No acetabulum. Pharynx globular; intestine bipartite. A distinct pore situated ventrally near the root of the tail.

Length of sporocysts from $\frac{3}{4}$ to 1 mm. Length of cercariæ $\frac{1}{3}$ mm.

The sporocyst is quite active, elongating and shortening; retracting and projecting the pharynx. It also exhibits strong peristaltic movements, in which the body becomes constricted tightly just back of the pharynx or in any position beyond. The contraction gradually extending backward and dividing the body cavity into two compartments, the cercariæ are suddenly slipped through the constriction, one after the other from the posterior to the anterior compartment. The movements of the cercaria, liberated from the sporocyst, consist mainly in elongation and narrowing and shortening with widening of the body. Elongation of the body causes it to exceed the length of the tail. At times the lateral extremities of the posterior emargination of the body are prolonged into short conical appendages.

This fluke occurs abundantly beneath the muscular tegument, among the lobes of the liver, and folds of the intestine of *Planorbis*

parvus. Upwards of fifty of the sporocysts distended with cercariæ have been removed from a single Planorbis.

DISTOMA (GYMNOCEPHALA) ASCOIDEA.

Sporocyst white. Head distinct from the body, campanulate, varying in the proportion of length to breadth, according to the degree of contraction. Body cylindroid, with a pair of lateral conical appendages, beyond which it extends as a cylindro-conical tail-like prolongation. Pharynx globular, encircled with six equidistant organs (undetermined in character, probably teeth? or perhaps ganglia). Stomach a flask-like pouch extending but a short distance from the head into the body cavity, and not reaching the middle of the latter even in its most shortened condition; bright brown in color. Body cavity distended with numerous cercariæ; the immature ones occupying the tail-like prolongation. An orifice at the extremity of a blunt conical snout communicates with the body cavity just back of the head. *Cercaria*, white; with an obcordate, or when elongated a clavate body, and a long, narrow, cylindro-conical pointed tail. Cephalic end triangular, and slightly constricted from the rest of the body; posterior part broadly emarginate. A ventral acetabulum near or posterior to the centre of the body, and between it and the root of the tail an oval pore. Eyes none. Pharynx globular; gizzard small; divisions of the intestine extending about two-thirds the length of the body.

Length of sporocysts of different ages, from $\frac{1}{8}$ to 1 mm. Length of cercariæ $\frac{1}{4}$ to $\frac{2}{3}$ mm.

In motion the sporocysts contract the head so that it may be of nearly equal length and breadth, and it may be extended so as to be double the length of the breadth. The body also elongates and shortens in the same manner. Cercariæ were observed in several instances escaping from the snout-like projection of the body cavity back of the head. The cercariæ in movement elongate excessively, and the body may be extended so as to be almost as narrow as the root of the tail. The ventral disk is often protruded into a conical appendage or expanded into a broad cup. The tail becomes longer, narrower, and more pointed, or shorter, wider, and beaded.

This fluke occupies a similar position in the Planorbis as in the former, and has been found in equal numbers, but the two species have not been found associated in the same individual. The distoma form of the ascoid fluke, encysted, was also observed in *Planorbis parvus*, without any traces of the generative organs being obvious.

A free swimming cercaria, identical in character with that of the ascoid fluke, has been observed in water, which contained many individuals of *Planorbis parvus*, and *Limnæa elodes*. The free cercaria agrees with the description of the *Cercaria minuta*, Nitzsch, found with various fresh-water mollusks of Europe.

Prof. L. further exhibited drawings of a Distoma, the *Rhopalocerca tardigrada*, Diesing, from the mantle of *Anodon fluviatilis;* a second the *Heterostomum echinatum*, Diesing, from the oviduct of *Paludina decisa;* and a third from *Helix arborea*, thus described:—

DISTOMA APPENDICULATA.

Translucent white, band-like, widest in front and rounded at the head, tapering behind and truncate at the end. Pharynx and ventral disk large and nearly equal and about $\frac{1}{8}$ mm. diameter. The gizzard comparatively large and oval. Intestine bifurcate with the branches parallel, and with an intermediate pouch-like appendage extending nearly half way to the position of the ventral disk. A posterior opening communicates with a pouch and a water vascular system. No traces of a generative apparatus observable. Length 1 mm.

Andrew C. Craig, William John Potts, John E. Cook, Chas. Zentmayer, Samuel L. Fox, Shippen Wallace, and Jos. D. Schoales, M.D., were elected members.

S. Fisher Corlies was elected a member of Council for the unexpired term of Dr. J. G. Hunt, resigned.

The following papers were ordered to be published:—

NOTES ON THE NATURAL HISTORY OF FORT MACON, N. C., AND VICINITY. (No. 3.)

BY H. C. YARROW.

In the Proceedings of the Academy of Natural Sciences for 1871 a series of papers was commenced, by Dr. Elliott Coues, with the above title, and it was determined to continue them from time to time until the fauna and flora of the locality—so far as had been observed—should be described, but owing to unavoidable circumstances the publication of certain of the papers has been delayed until the present moment. It is now proposed to continue them under the joint authorship of Dr. Coues and the writer.

FISHES.

It will readily be seen, upon a perusal of a foregoing article describing the situation of Fort Macon, Beaufort harbor, and the adjoining waters, that the circumstances of its position render it peculiarly attractive and interesting to the student of Ichthyology, affording an admirable field for obtaining specimens, the following list showing that one hundred and seven species of fishes have been secured by Dr. Coues and the writer during the short period of their residence at that point.

In the identification of the specimens thanks are due for assistance to Prof. S. F. Baird, Prof. Theo. Gill, Prof. F. W. Putnam, and Prof. G. Brown Goode. The classification and names given are those adopted by Prof. Gill in his Catalogue of the Fishes of the East Coast of North America, Smithsonian Miscellaneous Collections, No. 283, 1873. Local names are given whenever known, but these names are mostly those used by the inhabitants of the region under discussion. Species marked with C. represent those secured by Dr. Coues, with Y. by Dr. Yarrow, C. and Y. by both.

Chilomycterus geometricus (Linn.), Kaup.
Spiny Toad-fish. Sea Porcupine.

Tolerably common; found in nets and taken with hook from wharf. Size from four to six inches. Is not eaten. C. and Y.

Tetrodon lævigatus (Linn.), Gill.
Puffer. Smooth Puffer.

Found in small streams running through salt marshes; but few seen. Found in nets, and is taken with the hook. Never eaten, being considered poisonous. Size, from three to six inches. Y.

Chilichthys turgidus (Mitch.), Gill.
Puffer. Balloon-fish.

Common; found in same localities as preceding species, and, like it, is generally found in nets, but will also take the hook. Not eaten. Y.

Lactophrys trigonus (Linn.), Poey.
Camel-fish. Box-fish.

Prof. Gill states that the appearance of this fish on the coast is accidental. Two specimens were found on the beach at Fort Macon after a southeast gale.

Alutera cuspicauda, De Kay.
File-fish.

Is probably rare, as but a single specimen was taken. C.

Ceratacanthus auriantiacus (Mitch.), Gill.
File-fish. Devil-fish.

Tolerably abundant, generally taken on outer beach in mullet nets. Specimens vary in size from three to eleven inches. Is not eaten. C. and Y.

Stephanolepis setifer (Bennett), Gill.
File-fish. Fool-fish. Devil-fish.

This species is more abundant than either of the two preceding species, and is taken in same localities and in same manner. Is not eaten. C. and Y.

Hippocampus hudsonius, De Kay.
Sea-horse. Horse-fish.

Specimens seen were very small, and the species is doubtless rare, as several were presented to the writer by the fishermen as great curiosities. The occurrence of this fish at Fort Macon increases its southern distribution by nearly one hundred and fifty miles, its limits, according to Gill, extending from Cape Cod to Cape Hatteras. C. and Y.

Syngnathus peckianus, Storer.
Pipe-fish.

Few specimens seen; of small size; taken in nets and by dredg-

ing on Bird Shoal (the home of *Lingula*), between Fort Macon and Beaufort. None seen after July. Size from two to six inches. C. and Y.

Fistularia tabaccaria (Linn).
Trumpet fish.

Uncommon. One specimen was taken on the beach Sept. 25, 1871, 12 inches in length, another smaller one in November of the same year. Y.

Platysia plagiusa (Linn.), Gill.
Flounder.

Abundant on shoals in Beaufort Harbor. Will take the hook freely, but is generally captured by spearing after nightfall. Is esteemed a valuable food fish. C.

Achirus lineatus (Linn.), Cuv.
Flat-fish. Flounder.

The same remarks will apply to this as to preceding species, except regarding abundance, the fishermen considering it rare. Y.

Pseudopleuronectes americanus (Walb.), Gill.
Flounder. Flat-fish.

Rare as compared with other species of this family, few specimens being seen.

Lophopsetta maculata (Mitch), Gill.
Spotted flounder. Plaice. Fluke.

Exceedingly abundant from early in the spring until late in the fall on sand shoals and beach inside of inlet. Is taken in nets, and by hook and spearing at night. It is a peculiarity of the flounders to approach the shore at night and bury themselves in the sand, leaving only the snout and eyes exposed, and the fishermen being aware of this fact are enabled to capture very many in the following manner. A canoe is prepared with a grating or pan in the bow to contain fat pine, which, being lighted, the boat is propelled slowly by a person in the stern while another, armed with a spear, stands in the bow behind the fire. The craft is made to approach the shore closely, and as the eyes of the fish reflect back the fire-light they are easily seen, and the spear is driven into the sand a few inches behind the point where they appear. Hundreds of fishes are taken in this manner. In some instances the fisherman simply walks along the shore carrying in his hands a torch and spear. This species is considered excellent food. Size from one

and a half inch to twenty-eight and a half inches, the size of a specimen obtained in Sept. 1871. C. and Y.

Chænopsetta occellaris (De Kay), Gill.
Chænopsetta dentata (Linn.), Gill.
Flounder. Flat-fish.

Both species tolerably abundant. C. and Y.

Chænopsetta oblonga (Mitch.), Gill.
Four-spotted Flounder. Fluke.

Not so abundant as preceding species, but is occasionally taken of large size. From this locality it is recorded as its farthest southern distribution. Y.

Urophycis regius (Walb.), Gill.
Spotted Codling.

Apparently rare, but one specimen having been secured. C.

Ophidium marginatum, Mitch.
Cusk.

Single specimen only observed. C.

Zoarces anguillaris (Peck), Storer.
Eel-pout.

In May, 1871, two specimens were taken by hook from the Fort Macon wharf; these were small in size; none seen thereafter. Y.

Blennius fucorum, Cuv. and Val.
Sea-weed fish.

A single specimen seen, which was found in refuse of net. Y.

Hypleurochilus punctatus (Wood), Gill.
Spotted sea-weed fish.

Tolerably abundant. C. and Y.

Batrachus tau, Linn.
Toad-fish. Oyster-fish.

Exceedingly numerous in small marshy creeks, and are a great nuisance to anglers. In April, 1871, a female was discovered watching her eggs, which had been deposited in an old boot-leg; the tide had receded, leaving her in about four inches of water, and, although attempts were made to drive her away, she preferred to remain, and was consequently captured. Eggs have also been discovered in old tin cans. The size of individuals seen varied from four to eight inches. C. and Y.

Astroscopus anoplus (Cuv. & Val.), Brevoort.
Star-gazer.

Rare, but a single specimen taken. C.

Prionotus punctatus (Bloch), Cuv.
Spotted flying-fish. Sea Robin.

Prionotus carolinus (Linn.), Cuv. and Val.
Flying-fish.

Both species tolerably abundant during spring and summer. Are taken in nets and by hook. Size six to ten inches. C. and Y.

Tautoga onitis (Linn.), Gthr.
Black-fish.

Apparently rare, as but few specimens were seen. Y.

Cheilojulis grandisquamis, Gill.

But one specimen secured. Y.

Xiphias gladius, Linn.
Sword-fish.

Not seen, but reliable information received of its occasional appearance near Cape Lookout. Y.

Trichiurus lepturus, Linn.
Sword-fish. Hair-tail.

Not abundant, the few secured being taken just inside the surf in mullet nets. Have seen them in company with Gars swimming on surface of the water near the wharf feeding on small fishes, at which time they would snap at a baited hook, but none were captured. Are called "sword fish" by the fishermen, from their resemblance to the blade of a sword. Size averages from 30 to 40 inches; one specimen of 48 inches secured. C. and Y.

Sarda pelamys (Linn.), Cuv.
Bonito.

Tolerably abundant near Shackleford Banks. Y.

Orcynus secundi-dorsalis (Storer), Gill.
Bonito. Albicore. Sun-fish. Horse Mackerel.

First noticed in May, after which time it became tolerably abundant. A number of specimens were taken on the beach, upon which they had leaped from the water. Is frequently found in company with blue fish in September, and its appearance within the inlet is regarded by the fishermen as a sure indication of rough weather outside. Is not eaten. Size from four to twenty-four inches. Y.

Cybium maculatum (Mitch.), Cuv.
Spanish Mackerel.

Very abundant in latter part of August and September, and is frequently found with blue-fish. A favorable locality is near the southern point of Shackleford Banks, and it is there taken in nets and by hook; a great many are also taken near Cape Lookout in gill nets in September. Is highly esteemed as food, but is not often eaten fresh, being generally salted. Size from ten to thirty inches. C. and Y.

Cybium regale (Bloch), Cuv.
Spotted Mackerel. King-fish.

Not abundant, a single specimen only being seen. Y.

Vomer setipinnis (Mitch.), Ayres.
Horse-fish. Sun-fish.

Abundant in the fall, numbers being taken on outer beach in company with mullet. C. and Y.

Selene argentea, Lac.
Moon-fish. Sun-fish.

Same remarks apply as to the preceding species. C. and Y.

Argyriosus vomer, Lac.
Moon-fish.

Argyriosus capillaries (Mitch.), De Kay.
Moon-fish.

Not so abundant as the preceding species; are found in their company, and it will be seen that the fishermen of the locality recognize no specific differences, calling them all either moon- or sun-fish. First appear in Beaufort Harbor about May. C. and Y.

Paratractus pisquetos (Cuv. and Val.), Gill.
Yellow Mackerel.

A single specimen seen in September, 1871. C. and Y.

Carangus hippos (Linn.), Gill.
Horse Mackerel.

Carangus chrysos (Mitch.), Gill.
Yellow Mackerel.

Not abundant, a few seen in early fall, and one specimen fourteen inches long taken May, 1871.

Blepharichthys crinitus (Akerly), Gill.
Moon-fish. Shoemaker.

A few individuals taken in summer and fall; largest seen twelve inches long. Y.

Trachynotus carolinus (Linn.), Gill.
Pompano. Sun-fish.

Abundant in fall, and is taken in the mullet nets. Considered an excellent food-fish. C. and Y.

Hauerates ductor (Linn.), Raf.
Pilot-fish.

No specimens secured, but the appearance of the fish was so accurately described by several fishermen as to remove all doubts regarding its occasional occurrence. Y.

Balatractus sonatus (Mitch.), Gill.
Rudder-fish.

A single specimen observed. Y.

Peronotus triacanthus (Peck), Gill.

Not abundant. C. and Y.

Cynoscion carolinensis (Cuv. and Val.), Gill.
Speckled Trout.

Very abundant from February to June, April being considered the best month; are taken at this time in nets only, as they will not take the hook until September, upon their return from the northward. The roe in female specimens was found to be quite large in April. Size from six to thirty-six inches; one specimen, taken September, 1871, with hook, measured twenty-four inches in length and weighed three and three-quarters pounds. In 1872 the species first appeared January 9th, which was considered unusually early. C. and Y.

Cynoscion regalis (Bloch), Gill.
Weak-fish. Sea Trout. Gray Trout.

Not so abundant as preceding species, appearing with them in early spring; tolerably abundant in summer; taking the hook freely. Size ten to thirty inches. Y.

Pogonias chromis, Laup.
Drum.

Exceedingly abundant, resident, and is taken both within and outside of inlet. This species runs in schools in early spring, but in the fall is generally found alone, and will take the hook. A very large specimen was taken in September, while trolling for blue-fish. Is not considered a good table fish, the flesh being coarse, rank, and stringy. Size ten inches to five feet. C. and Y.

Liostomus xanthurus, Lacep.
Yellow tail.

Abundant in fall. Y.

Liostomus obliquus (Mitch.), De Kay.
Robin. Pin-fish.

ry abundant. C. and Y.

ella punctata (Linn.), Gill.
Yellow-finned Perch.

Occasionally seen. C.

Sciænops ocellatus (Linn.), Gill.
Spotted Sea Bass.

Not abundant; a few seen in fall. C. and Y.

Menticirrus alburnus (Linn.), Gill.
Whiting.

Menticirrus nebulosus (Mitch.), Gill.
King-fish. Whiting.

Menticirrus littoralis (Holbr.), Gill.
Sea Mullet.

These species are all more o abundant in the fall, when they are found in company with the mullet on sea-beach. C. and Y.

Micropogon undulatus (Linn.), Cuv. and Val.
Croaker. Crocus.

Abundant, and can be taken from March until August. Size four to eight inches. C. and Y.

Lagodon rhomboides (Linn.), Holbr.

Not abundant. C. and Y.

Archosargus probatocephalus (Walb.), Gill.
Sheepshead.

Abundant in early spring; will not take the hook until later in season. In 1871 large numbers were taken in the bight of Cape Lookout in nets. Size eight to twenty-four inches. A small specimen was taken January 30, 1872; an early arrival. Y.

Stenotomus argyrops (Linn.), Gill.
Scup. Porgy.

Abundant. C. and Y.

Prof. F. W. Putnam, to whom is due the identification of the specimens collected by Dr. Coues, states that in the collection he found an individual resembling *S. argyrops*, but which differed in

several essential particulars, having a well-marked black blotch on the tail immediately posterior to the dorsal fin, a very fine margin of black on the membrane of the spine of the dorsal fin, the ventrals dusky. D. xii. 14; A. iii. 13.

Hæmulon arcuatum, Cuv. and Val.
Hog-fish. Grunts.

Very abundant in early spring and summer, and are generally found in the marshy creeks inside of inlet. Size four to eight inches. Y.

Orthopristis fulvomaculatus (Mitch.), Gill.
Spots.

Abundant; resident in same localities as preceding species, and may be taken at all seasons of the year. Size four to eight inches. The young of this species found in company with young mullet in January, 1872. C. and Y.

Ephinephelus morio (Cuv.), Gill.
Grouper.

Very rare; one specimen only seen. Y.

Centropristis atrarius (Linn.), Barn.
Sea Bass. Black Bass.

Numerous off Shackleford Banks, in the vicinity of Cape Look-out. C. and Y.

Roccus lineatus (Bl. Schn.), Gill.
Striped Bass. Rock. Rock-fish.

Full-grown specimens seldom seen in the immediate vicinity of Fort Macon, but the young are abundant. In the New River, one of the affluents of Beaufort Inlet, adults are numerous, and in the Neuse they are exceedingly plenty. Y.

Morone americana (Gmelin), Gill.
White Perch.

No specimens seen in Beaufort Inlet, but they abound in the New and Neuse Rivers. Y.

Parephippus faber (Cuv.), Gill.
Horseman. Moon-fish. Pogy.

Not abundant; a few specimens taken from mullet nets in September. C. and Y.

Pomatomus saltatrix (Linn.), Gill.
Blue-fish. Tailor. Snapping Mackerel.

This species appears in Beaufort Inlet in early spring, but is

taken only in nets. In June it commences to take the hook, but the months of August and September are the best for trolling. At this time enormous numbers may be found in schools, swimming alongside shoals in tolerably rough water. On the 23d day of September, 1871, four persons, in four hours, took by trolling 660 Blue-fish. During the latter part of this month, in the same year, enormous schools were noticed in and near the ship channel, feeding upon the red-billed Gar, so-called, *Hemiramphus unifasciatus*, Ranz. The stomachs of individuals taken were literally crammed with these fishes. The very large specimens of blue-fish occasionally met with in the markets in January never enter Beaufort Inlet; they are taken on the beach from Cape Lookout northward, the run lasting sometimes two months, occasionally only a week or ten days. During the last week of December, 1871, large schools of young blue-fish were noticed in Beaufort Inlet swimming from the southward, apparently making for the sea; their size about four inches. C. and Y.

Elacate canadus (Linn.), Gill.
Crab-eater.

The fishermen speak of a fish which is supposed to be this species; none were seen.

Leptecheneis naucrates (Linn.), Gill.
Sucker.

Uncommon; two specimens seen. C. and Y.

Echeneis remora, Linn.
Sucker.

Uncommon; a few specimens seen, which were taken by the fishermen on Shackleford Banks. They stated that these fish were found ? in the mouths of sharks. Size of specimen six inches. Y.

Sphyræna borealis, De Kay.
Barracuta.

Uncommon; a few taken occasionally near Cape Lookout.

Mugil lineatus, Mitchell.
Striped Mullet. Mullet.

This species is the most abundant of the locality, and affords sustenance and employment to thousands of persons on the coast of North Carolina. From the month of May, when small-sized individuals appear, fishing continues during the entire summer

with gill and small draw nets, and in the latter part of August, as the fish commence to school preparatory to migration, the regular seine fishing commences, and continues frequently until November. The schools appear to come from the northward through Albemarle, Pamlico, and Cove Sounds, gradually working their way to the southward. Their departure through the various inlets seems to depend upon a favorable state of the wind, which should be from the northward, for it has been noticed frequently that when the wind hauled, the schools of mullet already without the harbor have suddenly turned, re-entering the inlet, and pursued their course southward through Bogue Sound. Their movements through the water are quite slow, and a person without exertion may keep pace with them walking upon the beach. The numbers taken are simply enormous, sometimes as many as 500 barrels being secured at a single haul. It was estimated by competent observers that not less than 12,000 barrels of mullet were captured on the coast of North Carolina Friday, September 22, 1871. Regarding the spawning grounds of *M. lineatus* considerable uncertainty exists. At the time of their arrival at Fort Macon, in August and September, the females are enormously distended with roe, some, however, being more so than others, and it is supposed that the process of oviposit takes place from July until December, many remaining in the sounds for the purpose. Many schools of young mullet have been seen in Beaufort harbor during December and January, which could have been but a few weeks old. These young fishes suffer from a curious disease, which is characterized by the presence of a gradually increasing film upon the eyes, which finally destroys the sight, and myriads perish from this cause. They also suffer from parasites, one of which is long and thread-like, with a stellate head, the other, called by the fishermen "sea-louse;" these parasites have never been noticed by the writer upon adults. Size from one and a half inches to thirty. C. and Y.

Chirostoma notata (Mitch.), Gill.
Silver-sides. Smelt.

Atherina carolina, Val.
Sand-smelt.

Rather uncommon, a few specimens only seen. C. and Y.

Belone longirostris (Mitch.), Gill.
Bill-fish. Gar.

Is quite abundant; appearing in Beaufort Inlet in February. At this time it swims in schools, and many are taken in nets. When swimming near the surface of the water it will readily take the hook. Is eaten by poor fishermen and negroes, and the flesh is said to be good. The largest specimen seen measured twenty-four inches in length. C. and Y.

Exocœtus melanurus, Val.
Flying-fish.

Occasionally seen. Y.

Hemirhamphus unifasciatus, Ranzani.
Red-billed Gar.

Abundant during latter part of August and entire month of September. This species appears to feed along the beach in shallow water, and may be readily taken at night with a torch and scoop net. It is also found in the channel and along the edges of shoals where blue-fish congregate, this fish devouring enormous numbers. The small fry of fishes appear to be attracted by the bright red caruncle on the end of the lower mandible of *H. unifasciatus*, and, swimming near to it, lose their lives as a penalty for curiosity. C. and Y.

Scomberesox scutellatus, Lesueur.
Skipper. Sea-pike.

First observed in June, 1871, and in August of the same year several were taken with hook and line inside the inlet. Are not eaten by the fishermen, who declare them poisonous. Size twenty-four inches in length. Y.

Cyprinodon variegatus, Lac.
Minnow.

Fundulus pisculentus (Mitch.), Val.
Mummichog. Minnow.

Hydrargyra majalis (Walb.), Val.

Hydrargyra swampina, Lac.
Minnow.

These four species are exceedingly abundant in the marshy creeks, and are all called by the residents "Minnows." C. and Y.

Albula conorhynchus, Bloch and Schneider.
Lady-fish.

Not observed by Dr. Coues or the writer, but is admitted to the list upon the authority of a reliable fisherman of the locality, Capt. A. Guthrie.

Elops saurus, Linn.
Sea-Pike.

Occasionally noticed. C. and Y.

Megalops thrissoides (Bl. and Sch.), Günth.
Jew-fish. Tarpum.

Said by fishermen to be very rare. None observed.

Brevoortia menhaden (Mitch.), Gill.
Menhaden. Mossbunker. Fat-back. Yellow-tail.

Very numerous in August and September; large numbers are netted and used for oil and manure. C. and Y.

Alosa sapidissima (Wilson), Storer.
Shad.

Not abundant in vicinity of Fort Macon, but in the Neuse are excessively so. C. and Y.

Opisthonema thrissa, Gill.
Hairy-back. Thread Herring.

This species, as a rule, appears early in June, and is regarded as the avant-courier of the herring, so-called, *P. pseudoharengus;* it is abundant, but is not eaten to any extent. Size ten to twelve inches. Y.

Pomolobus pseudoharengus (Wilson). Gill.
Herring. Blue-back. Alewife.

Not abundant except in Neuse River, and the sounds further to the northward. In fact its scarcity near Fort Macon is such that no regular fishing is followed with a view to its special capture. Y.

Pomolobus mediocris (Mitch.), Gill.
Hickory Shad. Hicks. Fall-Shad.

Abundant; first noticed in March, 1871. Y.

Engraulis brownii (Gmel.), Val.
Smelt.

Several specimen secured, but the species is not common. Prof. Putnam, after an examination of specimens sent him, states as follows: "Mitchell's description of *Clupea vittata* does not differ from Günther's of *E. brownii*, but Günther's description of *E.*

mitchellii differs in anal rays and in length of maxillary, which does not agree with my specimens from Fort Macon."

Ælurichthys marinus (Mitch.), Baird and Girard.
Fork-tailed Catfish.

Ariopsis milberti (Val.), Gill.
Sea-Cat. Catfish.

Both species are occasionally met with near the Fort Macon wharf, but are by no means abundant. C. and Y.

Anguilla bostoniensis (Les.), De Kay.
Eel.

Very abundant in marshy creeks. C. and Y.

Acipenser oxyrhynchus, Mitch.
Sharp-nosed Sturgeon.

Acipenser brevirostris, Lesueur.
Short-nosed Sturgeon.

Both species said to be abundant in the North, New, and Neuse Rivers.

Ceratoptera vampirus (Mitch.), Gill.
Devil-fish.

None observed, but the fishermen state they are occasionally seen.

Ætobatis narinari, Müll. and Henle.
Sting-Ray. Lady-Ray.

Very common, sometimes growing to a large size. C. and Y.

Pteroplatea maclura, Müll. and Henle.
Sand-Skate. Butterfly Ray.

Very common in fall outside of inlet. Nov. 5, 1871, a specimen was captured five feet in width four feet in length. C. and Y.

Trygon centrura (Mitch.), Gill.
Sting-ray. Whip-ray. Stingarce.

Very common. Migration takes place southward in latter part of October. In July, 1871, a very large specimen was found expiring upon the beach; upon dissection the liver and gall-bladder were found filled with worms. C. and Y.

Torpedo occidentalis, Storer.
Cramp-fish. Torpedo. Electric Ray.

None observed; fishermen state they are rarely seen.

In this connection it may be mentioned that Capt. Absalom Guthrie, an intelligent fisherman of Shackleford Banks, stated to

the writer that upon a certain occasion, in removing fishes from his net, he received a very perceptible electric shock from a fish resembling the common toad-fish, *B. tau*, and upon repeating his examination of the animal he experienced the same sensation a number of times; when touching the head, the fish appeared to advance this organ as if eager to discharge the electric fluid. Expressing incredulity, a number of fishermen were called who corroborated Capt. Guthrie's statement in every particular. Some three or four specimens had been found in the net at this time, since which none have been seen, although a large reward was offered for living specimens.

Raia lævis, Mitch.
Skate. Winter Skate.

Common. Y.

Pristis antiquorum (Linn.), Lath.
Saw-fish.

Not observed in the immediate vicinity of Fort Macon, but is abundant in the brackish rivers emptying into Bogue and Cove sounds. It is frequently taken in the New River, and attains a considerable magnitude, the writer having secured a so-called "saw" five feet in length from an individual over sixteen feet long which had been captured in this river. The fishermen state that this species is exceedingly hostile to the porpoise, and will fight it whenever opportunity occurs. Y.

Isuropsis dekayi, Gill.
Mackerel-shark.

Very rare, a single skeleton having been seen. Y.

Eugomphodus littoralis, Gill.
Sand-shark. Shovel-nose.

Tolerably abundant both within and outside of inlet. Y.

Sphyrna zygæna (Linn.), Mull. and Henle.
Hammer-head Shark.

But a single individual seen. Y.

Reniceps tiburo (Linn.), Gill.
Shovel-head Shark.

Uncommon. Y.

A few other species of this family were noticed, but not identified.

Branchiostoma caribæum, Sundevall.
Lancelet.

This curious species, so far as known, is to be obtained in but one locality, near Fort Macon, viz., on Bird Shoal, which lies to the southward of Beaufort city; some dozen or more specimens were obtained by dredging. Y.

A number of species of fresh-water fishes have also been obtained from the rivers contiguous to Fort Macon, but it has been deemed advisable to confine this list to the marine forms almost exclusively. It should be mentioned that the inquiries regarding the preceding species of fishes were made at the suggestion and under the direction of Prof. S. F. Baird, U. S. Com. of Fish and Fisheries.

ON THE BRAIN OF CHIMÆRA MONSTROSA.

BY BURT G. WILDER, M.D.

INTRODUCTION.—At the close of a paper upon the brains of the fish-like vertebrates presented before this Academy on the 4th of April, 1876, I exhibited a fairly preserved adult male example of *Chimæra monstrosa*,[1] together with a drawing of the brain as then partly exposed. After calling attention to certain peculiarities which apparently had not before been observed, I expressed the intention of preparing a full description of it with figures for presentation to the Academy at a future meeting.

In the present paper this intention is fulfilled so far as I have been able, in view of the limited material at my command, and the difficulties of interpretation which now embarrass all students of fishes' brains.

The extent of these difficulties becomes apparent when I state that, since Gegenbaur has lent the weight of his high authority to Miklucho-Maclay's new interpretation of the parts commonly called cerebellum and optic lobes, *no region of the brain is clear as to its homology throughout the series of fish-like vertebrates.*

For the complete solution of these homological problems it is evident that simple and embryonic brains are primarily more useful than those of adults, or those which present peculiar characteristics. Hence I am availing myself of every opportunity for preparing and figuring, both as wholes and in sections, the brains of *Myxine*, *Petromyzon*, *Menobranchus* (or *Necturus*), and embryo sharks. But it is not likely that an embryo *Chimæra* will soon be available, and it seems hardly advisable to longer defer the publication of facts, some of which, at least, appear to be new and important, simply on account of doubts respecting the terms which should be employed for the designation of parts. Moreover, notwithstanding its special peculiarities, the brain of *Chimæra* presents certain features which may enable us to connect brain-forms which have hitherto failed to be reconciled with each other, or with the ideal, or typical brain, as now commonly accepted.

[1] Kindly placed at my disposal by Mr. Alexander Agassiz, Curator of the Museum of Comparative Zoology at Cambridge, Mass.

Again, as will be shown in the following historical sketch, the brain of *Chimæra* has not hitherto been accurately figured or fully described.

This fact alone would have led me to welcome an opportunity of adding to our knowledge of its structure; but an additional incentive lay in the consideration that the three species of *Chimæra*, with the single species of *Callorhynchus*[1] have always been regarded as peculiar, and not readily assignable to a place among the fish-like vertebrates.

In 1834 Johannes Müller (23, 74) united the two genera under the title Holocephala, regarding this group as an order of the class Pisces.

Some zoölogists have adopted Müller's view; but the Holocephala are often included with the sharks and skates under the name Selachians, or Elasmobranchiata.

So far as I am aware the structure of the brain has never been appealed to for the purpose of ascertaining the taxonomic relations of the Holocephala. I say the *structure*, because in the arrangement proposed by Mayer (5), little more than the external form of the brain seems to have been considered.

Historical Sketch.—So far as I am aware, the earliest account of the brain of *Chimæra* was by Valentin, in 1842. He states (1, 25) that his specimen was "well-preserved in alcohol;" but, judging from the figures, its condition was that of most fish-brains which are not exposed to the action of alcohol very soon after death of the animal. The principal features, however, are shown in so far as the brain was exposed; but it is evident from both the figure and description that only the hinder region of the brain was examined, and that Valentin failed to discover the olfactory lobes, the "hemispheres," and the greatly elongated mesothalamic crura, which are characteristic of this type of brain.

He does not state whether the brain was removed from the skull by himself. The channel connecting the hinder part of the brain-cavity with the front part is so narrow that the existence of

[1] Günther (19, viii. 349-352) recognizes the following species of *Chimæra*, viz.: *monstrosa*, coasts of Europe, Japan, Cape of Good Hope; *colliei*, west coast of North America; *affinis*, coast of Portugal. He also admits but a single species of *Callorhynchus*, *antarcticus*; but Duméril (29, 692) enumerates five. References are here made to a list of works at the close of this paper.

the latter might well be overlooked by an assistant. Still the general aspect of the regions examined by Valentin differs so much from that of any other entire brain that it is not easy to see how he could have stated his determinations without some qualification.

The short portions of the crura which were retained with the hinder regions of the brain, were regarded by Valentin as the olfactory nerves, and they are figured of considerable thickness, although in my specimen they are thin and ribbon-like. The rounded optic lobes he named hemispheres. The overhanging cerebellum was interpreted as the thalamus, or *lobus ventriculi tertii*, and the remaining parts as cerebellum and medulla. On pages 32 and 33 Valentin speaks of the cavity of the optic lobes ("Sehlappenhöhlung"), and designates it on fig. 4 (*s*); but neither the figures nor the description indicate distinctly the parts which he regarded as the optic lobes themselves; they must certainly have been very small in comparison with the supposed thalamus, since all the other conspicuous portions are otherwise interpreted.

Valentin's opinion as to the taxonomic significance of the brain is expressed in the following passage.

"Peculiar as the brain of *Chimæra* appears at first sight, it nevertheless proves to be intermediate between the brain of the Cyclostomes [Myzonts], on the one hand, and that of the Plagiostomes on the other." (1, 39.)

The following year, in his Report upon the progress of Anatomy (2), Johannes Müller commented as follows upon the paper of Valentin:—

"Of the brain of *Chimæra* we had before no figures, so that these by Valentin, with his description, supply a real deficiency. In the designation of the parts, however, and therefore also in the comparison with other brains, some things prove to be otherwise.

"The description and figures make it very probable that a part of the medulla oblongata is taken for the cerebellum. This remark of R. Wagner I find to be confirmed by the examination of a well-preserved specimen of the brain of *Chimæra*.

"What is called cerebellum belongs to the medulla, whilst that which the author calls 'the hammer-formed body' and compares with the lobus ventriculi tertii of Cyclostomes is the cerebellum.

The cerebellum and medulla with *Chimæra* closely resemble those of all genera of sharks whose brains are known to me."

"The brain of *Chimæra* has no resemblance to that of Cyclostomes, but much to that of sharks. Yet it differs greatly therefrom in the front part, because the optic lobes and the hemispheres are fused together, which is not the case with the sharks and skates. The olfactory nerves, as usual, enlarge behind the olfactory folds into a bulb. The small swelling from which they spring is the only representative of the great median masses of sharks which are probably the hemispheres."

I have been unable to find the observation of R. Wagner, above referred to, elsewhere recorded, but the foregoing passages lead me to infer that both he and Müller, like Valentin, believed the entire brain of *Chimæra* to be included in what was really only the posterior portion. It will be seen farther on that Gegenbaur attaches a different signification to Müller's remarks; but after careful re-examination of the passage I find myself obliged to adhere to the interpretation above offered.

In 1848, Busch published (3) figures of the brains of *Chimæra* and of *Callorhynchus;* the latter, however, represents only the posterior region. I am informed that a copy of this work has been obtained for the American Museum of Natural History in New York; but the library of which it forms a part has not yet (April, 1877) been placed upon shelves, and I have not been able to examine it.

These figures of Busch were reproduced in 1864 by Mayer (5). Like many other figures upon the plates of this author, the general aspect of these is good, but they are unsatisfactory in respect to details.

Mayer's description (5, 24, and 25) of these brains is in the form of a classification. The Holocephala are included under "Pisces Proëncephali," characterized as having "the olfactory lobe developed into an olfactory hemisphere or cerebrum." This group includes all the fish-like forms excepting the Teleosts which he designates (5, 27) as Pisces Mesencephali, the optic lobe being the hemisphere.

The brains of the Proëncephali are further characterized as follows: "The olfactory lobe is two to four times greater than the optic lobe, presents folds or lobes upon its upper surface, and in the middle two open lateral cavities with swellings within them."

"The optic lobe is small, spherical, without superficial commissure of the two hemispheres, or without *corpus callosum*,[1] and is separated from the olfactory hemisphere by an anterior prolongation of the *crus cerebri*. The basilar lobes [hypoaria?] are little developed. The cerebellum varies in size, so as to form a series. There is a chiasma."

Mayer subdivides the "Proëncephali" into three suborders and includes the Chimæræ in the Macroëpiencephali corresponding with Selachians, or Plagiostomes and Holocephali. The characters are as follows: "The optic lobe contains a rudimentary ventricle, which is afterward united with the third ventricle, but no inner swellings. The chiasma is broad. The cerebellum consists of an anterior and posterior median mass and anterior and posterior convoluted lateral lobes more or less developed."

The "Macroëpiencephali" are subdivided into two families, the Raiæ or Skates, in which the hemisphere mass is "as broad as it is long;" and the sharks and Holocephali, in which it is an "elongated oval."

Finally, this "family" forms two groups, in one of which "the cerebellum is very large and covers part of the hemisphere," while in the other it "reaches only to the middle of the optic lobes." In this group are included, *Galeus canis*, *Scymnus lichia*, *Carcharias glaucus*, *Scyllium catulus*, *Scyllium borealis*, *Callorhynchus*, and *Chimæra monstrosa*.

In a note (p. 25) Mayer says, "The hemisphere is particularly slender and long in *Scymnus lichia* and *Chimæra*. Valentin's figure cannot be employed for a different interpretation of the parts. At any rate what Valentin calls the *lobus ventriculi tertii* is really the cerebellum."

The foregoing description indicates that Mayer's attention was directed chiefly to the form and general aspect of the brain, and that many of his determinations were based upon analogy rather than homology.

By implication Mayer ascribes lateral ventricles to all the Proëncephali; but he makes no special mention of them in the Holocephali, and neither the figures nor descriptions indicate the existence of the large "foramina of Monro," and the swellings therein which are described by me farther on.

[1] Alluding to certain structures, which he regards as representing the *corpus callosum*, with the Mesencephali.

The brains of Holocephala are not mentioned by Hollard, or Vulpian (4).

Owen copies (6, I, 276, fig. 179) Busch's figure of the brain of *Chimæra monstrosa*, and does not appear to have examined the brain itself. The olfactory lobes are united with the succeeding lobes (not separated as in Mayer's figure), and their necks appear to be connected by a thick transverse commissure, which has no existence; in the original figure this appearance may have been due to an unintentional exaggeration of shadow.

According to the plan of the work, the author's views of the Chimæroid brain are given in connection with his account of its separate divisions. The laminæ at the sides of the medulla are regarded (p. 276) as developments of the restiform columns. The optic lobes are mentioned (277) as smaller than either the cerebrum or cerebellum. The "cerebral crura" (called by me *mesothalamus*) are said (281) to "advance some way before they expand into the prosencephala." The latter are described (282) as "large, elongated, and smooth." On the same page it is said that neither the cerebellum nor the optic lobes are so large as the "prosencephalon;" but on page 288, the cerebellum is said to be "large."

In 1869, Gegenbaur published (8) an extract from a letter from Miklucho-Maclay relating to some peculiarities of the Chimæra's brain, adding remarks upon their morphological and taxonomic significance.

"The brain of *Chimæra*, as presented in the figures and description of Valentin, offers so many peculiarities that it was impossible to discuss it alone, or in connection with the other series of fish brain-forms.

"Miklucho found that the above-mentioned representation agreed in part with the results of his investigations of the brains of Selachians, but in other respects was wholly dissimilar. That representation showed a Zwischenhirn,[1] which is similar to that of Selachians. Valentin took it for the hemisphere. From it proceed a pair of swellings which were supposed to be the olfactory lobes. Then follows a portion corresponding to the Mittelhirn

[1] This is the common German term for the Thalamencephalon, or lobi ventriculi tertii; but Miklucho and Gegenbaur apply it, incorrectly, as I believe, to the optic lobes or Mittelhirn, and give this latter name to the cerebellum. This question will be discussed hereafter.

[really the cerebellum], which Valentin named Zwischenhirn; then a cerebellum with a medulla oblongata, which, interpreted as such by Valentin, present the characteristics of these parts with Selachians.

"So the greater part of the brain agrees with that of the Selachians, but where is the Vorderhirn?

"In Messina Herr Miklucho found the opportunity for investigation of the brain of *Chimæra*, and writes as follows: 'In the first place, I learn that the representation of Valentin is quite correct in some minor points. But the part which Valentin calls the olfactory tract, I ask myself, is not this the *Hirnstiele*? I extended the opening of the cranium, and, true enough, far forward lay the large and handsome hemispheres connected with the Zwischenhirn by elongated cerebral peduncles.'

"This Vorderhirn therefore corresponds to the part described by J. Müller (2) as the swelling of the olfactory nerves lying behind the olfactory folds. Since, moreover, there is a swelling which gives off olfactory nerves, there can be no doubt respecting the above-mentioned interpretation.

"The peculiarity of the Chimæra's brain consists, therefore, especially in the remarkable extension of the brain-stem, and the concomitant separation of the Vorderhirn from the Zwischenhirn. In the same degree in which the Vorderhirn is moved forward, the olfactory tracts are abbreviated, so that the swellings of the olfactory nerves are in contact with the Vorderhirn itself.

"The brain of *Chimæra* therefore resembles that of Selachians much more closely than was supposed by J. Müller, although the great similarity of the hinder regions was by no means unknown to him."

Gegenbaur does not mention the figures of Busch, which, like the copies of Mayer and Owen, present all the features whose discovery he seems to ascribe to Miklucho.

On the other hand he credits Müller with being acquainted with the existence of these parts. As already stated, I cannot find, in Müller's remarks, any evidence of such knowledge. On the contrary, he distinctly says that "the lobi-optici and lobi-hemisphærici are closely united."

Miklucho-Maclay, in 1868 and 1870, published two papers (7 and 10) upon the brains of fishes, but in neither do I find any reference to the brain of *Chimæra*.

The paper of Panceri and de Sanctis (9) is known to me only through a brief abstract in the Zoological Record for 1872, p. 86. It does not appear to treat especially of the brains of the Holocephala.

Duméril, who describes (21, I, 65–73, pl. 2) somewhat at length, though apparently not from original investigations, the brains of Plagiostomes, makes no reference to those of Holocephala; neither are they alluded to in the Manuals of Van der Hoeven or Rolleston.

In 1871, Huxley included the Holocephala among the Elasmobranchs, and left it to be inferred (13, 118) that their brains resemble those of sharks and skates.

More recently, in his paper (16) upon the brain, the skull, and the pectoral fins of *Ceratodus*, Huxley makes some very suggestive remarks (pp. 30, 41, 45, 57) concerning the taxonomic relations of *Chimæra*. These will be referred to hereafter. I do not see, however, that he anywhere implies that the brain differs essentially from the plagiostome type, and in the summary (p. 41) of the characters upon which he is inclined to base the opinion that the Holocephala should be regarded as a primary subdivision of fishes, the brain is not even mentioned.[1]

In April, 1876, the following note was added while my paper on the brains of N. A. Ganoids (17) was passing through the press:

"Just as this goes to press I am enabled, through the kindness of Mr. Alex. Agassiz, to expose and examine the brain of a well-preserved male *Chimæra* in the Museum of Comparative Zoology. The cerebellum is very large and covers the optic lobes, but is not folded transversely as in most, if not all, adult sharks and skates. The crura thalami are very long and thin, and united ventrally by a delicate membrane, apparently only pia mater. Anteriorly each crus expands into a prothalamus, the dorsal border of which is thin and slightly everted. This prothalamus, however, instead of forming the principal anterior mass as in Ganoids, is overlapped outside by a large and elongated hemisphere about 8 mm. in height and 15 mm. in length. On the hinder third of the mesial surface is a large rounded foramen of Monro, 4 mm. in diameter. The lateral ventricle extends forward into the olfactory

[1] This paper was known to me only through a brief abstract in "Nature" for Jan. 6th, 1876, until Nov. 1876, when a copy was kindly loaned to me by Prof. S. F. Baird.

lobe. Into the foramen, and occupying its entire area, projects a thickening of the outer wall of the hemisphere which may represent a primordial corpus striatum. Just in front of the foramen the ventral borders of the hemispheres are connected by a transverse commissure. I greatly regret not having been able to examine this brain before presenting this paper. It seems to furnish an actual form intermediate between the apparently distinct types represented by the brains of Selachians, Ganoids, and Dipnoans. If I correctly interpret the appearance of a partial subdivision of the elongated mass behind the olfactory lobe, the Chimæra's brain presents a more equal proportion of hemisphere and prothalamus than exists in Ganoids or Teleosts, where the former seems to be reduced to a rudiment hardly recognizable as such."

Remarks to the same effect were made before the Academy on the 4th of April, as already mentioned.

The brain itself, with most of the drawings here published, was exhibited and remarked upon by me at the meeting of the American Association for Advancement of Science, Aug. 25th, 1876, in connection with a paper on the brains of certain fish-like vertebrates (24).

Prof. Huxley's comments (25) upon that paper referred mainly to the question of the homology of the optic lobes and cerebellum of Selachians, which will be more fully discussed hereafter.

THE GENERAL ASPECT OF THE BRAIN OF CHIMÆRA.—The brain of the adult[1] *Chimæra* presents three regions of nearly equal length, viz., a complex high mass behind, a pair of elongated masses in front, and an intervening pair of slender bands.

The height and complexity of the hinder mass remind one of the corresponding region with sharks and skates. In general form, the anterior masses resemble the hemispheres of Dipnoans; but the slightness of their union by a transverse commissure is a characteristic of Ganoids and Teleosts; while the length of the crura, and the size and position of an orifice upon the mesial surface of each anterior mass are features not hitherto observed, so far as I know, in the brain of any other fish-like vertebrate.

In general, therefore, it may be said that the brain of *Chimæra*

[1] From analogy we may infer that in very young examples the interval between the anterior and posterior regions is much less; also that the lobes of the medulla are less folded, and the cerebellum smaller.

presents certain features peculiar to itself; it also combines features more or less characteristic of the brains of Ganoids and Plagiostomes. The significance of these resemblances will be considered farther on.

THE TYPICAL BRAIN.—Notwithstanding great differences in the relative size and complexity of the principal subdivisions, and in the number of the accessory parts, the brains of all Mammals, Birds, Reptiles, and Batrachians may be referred to a single type. The reduction to this type may be made either by comparing many forms as intermediate stages of an ideal transition, or by tracing back the development of the brain of a single form to its earliest and simplest condition.

Among the remaining groups of fish-like vertebrates the lamprey eels (Petromyzontidæ) seem to possess brains closely resembling those of Batrachians. The Myxinoid brain has not yet been satisfactorily homologized with that of *Petromyzon*, but may prove to be a degenerated form thereof. As figured by Owen (20, and 6, I, fig. 186, p. 282), the brain of *Protopterus* seems to closely resemble that of the tailed Batrachians; but Huxley (16, 30) finds in *Ceratodus* (which is regarded as a Dipnoan) a feature which is characteristic of the plagiostome brain, so that the matter is still in doubt. The brains of Ganoids, and Teleosts, and Plagiostomes are not yet satisfactorily homologized with the typical brain; the same is the case with the Holocephala (17).

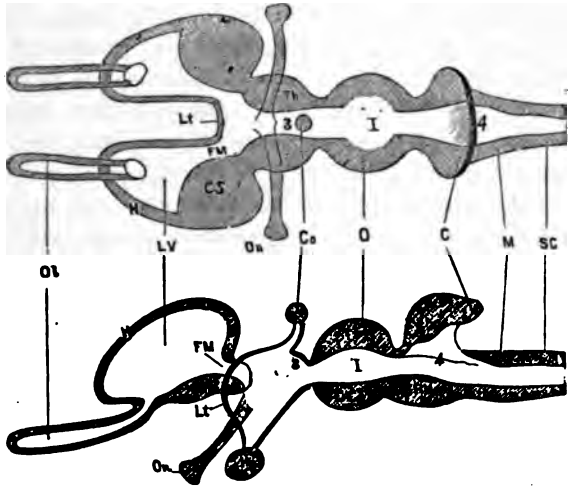
The typical brain comprises the following parts: *Medulla* and *fourth ventricle; Cerebellum* with its *ventricle; Optic lobes* with their *ventricles; Thalami*, with the *third ventricle*, *the conarium* above, and *hypophysis* below; *Hemispheres*, containing the *lateral* (first and second) *ventricles*, which communicate with the third through the *foramina* of *Monro; Olfactory lobes* with their *ventricles.*

Thickenings of the lower or outer walls of the hemispheres constitute the *corpora striata;* and these are joined by the *anterior commissure* which is a specialization of the anterior boundary of the third ventricle, the *lamina terminalis.*

The thalami are united posteriorly by the *posterior commissure*, and between their central portions may be formed the *middle* or *soft commissure.* The *fornix* seems to result from a thickening of the vertical fibres of the lamina terminalis in front of and

above each foramen of Monro, and from the subsequent union of the two series of fibres across the median line.

The *pons Varolii* is a band of transverse fibres upon the ventral side of the medulla, connecting the lateral regions of the cerebellum. The *corpus callosum* is a transverse commissure uniting the contiguous faces of the hemispheres. The corpus callosum and the pons Varolii seem to be confined to the mammals.



Diagrams (slightly altered from Huxley) representing the type of vertebrate brain. *S C*, spinal cord; *M*, medulla oblongata; 4, fourth ventricle; *O*, optic lobes; *I*, optic ventricle, or iter a tertio ad ventriculum quartum; *C Ce*, crura cerebri; 3, third ventricle; *Th*, thalami; *Co*, conarium; *On*, optic nerve; *F M*, foramen of Monro; *L V*, lateral ventricle; *H*, hemisphere; *C S*, corpus striatum; *Ol*, olfactory lobe; *Hy*, hypophysis.

Figures and descriptions of the typical brain are given by Huxley (13, 56–59); his figures were reproduced by me with slight modifications in a former paper (17, plate 3), and they are herewith presented again from a conviction that an understanding of it, and of the brains of Amphibia which most nearly embody the type, is essential to the successful study of the many and complex modifications which exist among the other vertebrates.

ENUMERATION OF PARTS.—Accepting, provisionally, the type of vertebrate brain as figured and described by Huxley, it is desirable to ascertain how far its subdivisions are recognizable in the brain of *Chimæra*.

Respecting the following parts there can be no doubt: The

spinal cord (*S C*), the optic nerves (*o n*), and chiasma (*o c*), and the olfactory lobes (*Ol*).[1]

But none of the intermediate regions have yet been determined satisfactorily as to their limits, and as to their correspondence with the subdivisions of the typical brain.

The cerebellum lies between the medulla behind, and the optic lobes in front. If the cerebellum, therefore, can be determined the other two parts will naturally follow.

The existence of a cerebellum is doubtful in the Myxinoids, and among the other fishes it presents very great diversities of size, form, and complexity. Thus in *Petromyzon* and the Dipnoans it is a narrow bridge; in *Lepidosteus* it is an inflated vesicle; in *Morrhua* it is retroverted, in *Pimelodus* anteverted. In skates, that which has been usually regarded as the cerebellum is a somewhat elongated and flattened mass which is distinctly single and median, although it may present a longitudinal median furrow. With many sharks this part is deeply furrowed transversely as in birds.

Prior to the year 1868, so far as I know, this region of the plagiostome brain was universally recognized as the cerebellum. But Miklucho-Maclay (7 and 10) has proposed to call this the *Mittelhirn* (optic lobes), and to restrict the term cerebellum to a narrow band (figs. 2 and 8, c′) between it and the medulla. The region commonly called optic lobes he names *Zwischenhirn* (thalami).[2]

Now there is certainly some ground for this view. The transverse lamina of sharks and skates is apparently identical with

[1] For obvious reasons the determinations of Valentin are not here considered.

[2] I feel constrained to protest against the introduction of the terms Vorder-hirn, Zwischen-hirn, Mittel-hirn, Hinter-hirn, and Nach-hirn, and of their English equivalents fore-brain, etc. If the conventional and universally understood terms medulla, cerebellum, etc., are to be discarded for descriptive names derived from one modern language, what is to prevent the anatomists of Spain, or Russia, or any other country from employing other descriptive titles derived from their own languages? Such substitutions would soon cause morphological science to revert to the chaotic condition in which descriptive zoölogy was found by Linnæus.

The region designated by thalami has already received the following names: Zwischen-hirn, between-brain, inter-brain, diencephalon, deutencephalon, lobus ventriculi tertii.

the visible cerebellum of Amphibia, Myzonts, and Dipnoans; it seems to represent the simple and primordial form of the organ. Nor is it easy to account for the sudden interpolation between it and the optic lobes of the greatly expanded or inflated mass commonly called cerebellum in other vertebrates.

But it is worth bearing in mind that, with some Ganoids, as *Acipenser*, and *Lepidosteus* (Wilder, 17, 181, fig. 7), the anterior border of the apparently simple cerebellum is continued forward into the cavity of the optic lobes. Why then may we not imagine that an eversion of this fold has given rise to the inflated or convoluted mass of sharks and skates? This would give us two distinct portions of the cerebellum; the posterior lamina, and the anterior vesicle.

To Maclay's interpretation assent has been given by Gegenbaur (12, 549; 14, 524). But neither of these anatomists has as yet published facts or arguments which warrant the abandonment of the older view, while several others have questioned the validity of their conclusions. Amongst these are Jackson and Clarke (15, 77); Balfour (26, 560); Huxley (16, 31–25); and myself (17, 172, and 24). In a letter to me, Prof. Rolleston has also expressed his non-acceptance of Maclay's view.

In his paper on *Ceratodus* (16, 31) Prof. Huxley says: "I cannot accept the views of Miklucho-Maclay, whose proposal to alter the nomenclature of the parts of the Elasmobranch's brain appears to me to be based upon a misapprehension of the facts of development."

My argument (24) against the view of Maclay was based upon the fact that in the brain of a large shark (*Carcharias obscurus*) the fibres of the optic tracts are distinctly traceable to the optic lobes and the thalami, and not at all to the cerebellum as should be the case if the cerebellum be really the optic lobes.

In commenting upon the paper just mentioned, Prof. Huxley (25) repeated the opinion expressed in the paper on *Ceratodus*, and called attention to the fact that wherever the fourth nerve (trochlearis or patheticus) has been identified among vertebrates, its apparent origin has invariably been between the optic lobes and the cerebellum. This point seems to have been considered by J. Müller,[1] and it is briefly discussed by Maclay and Gegenbaur,

[1] Vergl. neurologie der Myxinoiden, 1838, p. 215.

who, however, regard it as not constituting an insuperable objection.

There is one other consideration which appears to have been overlooked hitherto. Among the air-breathing vertebrates, from frog to man, the roof of the optic ventricle is complete, while that of the third ventricle is only partial. Posteriorly the dorsal borders are united by the posterior commissure, but anteriorly the true nervous tissue is absent, and the ventricle is covered only by the lining membrane and the overlying pia mater. According to the new interpretation, the thalami of fishes lack the feature which characterizes them throughout the series of air-breathing vertebrates, and assume the peculiarities of the optic lobes.

Should Maclay and Gegenbaur insist upon the correctness of their interpretation, the matter will need to be treated in full hereafter; but as, for obvious reasons, the material for its elucidation must be derived from sharks and skates rather than from *Chimæra*, I trust that in adhering in the present paper to the commonly accepted view I shall not be held to disregard the earnestness of Maclay, or the high authority of his distinguished teacher.

For reasons which will be presented farther on, I have designated the parts between the optic and the olfactory lobes as follows: the slender bands as the *mesothalamus;* their posterior enlargements as the *basithalamus;* their anterior enlargements as the *prothalami;* and the remainder of the elongated mass on each side which incloses a ventricle, as *hemisphere.*

The Spinal Cord (S C).—For at least 3 cm. behind the medulla the cord[1] is of uniform size and shape. Its greatest transverse diameter is 4 mm., and its vertical diameter 3 mm. As seen in the cross-section (fig. 22), its greatest width is ventrad of the centre, and the sides of the ventral median fissure (*v*) slope outward more gradually than those of the dorsal (*d*).

The nerves have been separated from the cord, but along the dorsal lateral line (fig. 1, *d l*) is a series of slight elevations about 2 mm. apart, which may indicate the points of origin of the dorsal roots of the spinal nerves; the ventral lateral line (fig. 4, *v l*) presents no such elevations. The lateral tract (*l c*) between the dorsal and ventral lateral lines is slightly elevated above the dorsal and ventral tracts (*d c* and *v c*), and, when first exposed, presented a darker color which disappeared in a few days.

[1] The remainder of the cord was not exposed.

The structure of the cord, and the homologies of its parts with those of the human spinal cord, should be determined by microscopic sections of better preserved specimens.

THE MEDULLA OBLONGATA.—The medulla consists of two parts, the *medulla proper* or continuation of the spinal cord, and two pairs of lobes which may be provisionally called *dorsal* and *lateral*.

The medulla may be said to commence at a point about 4 mm. behind the posterior end of the lobes, and about 3 mm. behind the angle of the fourth ventricle. At this point the cord begins to change its form and to increase in size.

The dorsal border preserves nearly the same direction as that of the cord itself, but the ventral border inclines ventrad, so that just behind the lobes the dorso-ventral diameter is 4 mm. At a point 4 mm. farther forward the ventral border is 2 mm. lower than the ventral border of the cord, and it remains at this level until suddenly deflected ventrad beneath the cerebellum.

The width of the medulla also increases so as to be about 6 mm. just behind the lobes. In front of this point the width becomes about 8 mm., on account of the prominent lateral lobes.

The dorsal lateral line (*d l*) begins to be deflected downward at the point of transition from the cord to the medulla; but its deflection is more rapid than that of the ventral border; the dorsal tract (*d c*) not only increases in width, but is slightly elevated above the lateral column. The distinctness of the dorsal lateral line (*d l*) ceases just in front of the posterior end of the lateral lobe, but the elevated ventral margin of the lobe follows the same general direction. The slight elevations which indicate this line upon the cord do not appear upon the medulla. The ventral lateral line (*v l*) gradually disappears at about the middle of the length of the medulla, as seen in fig. 4; the ventral median furrow (*v*) ends rather abruptly just behind the downward deflection of the ventral surface under the cerebellum; it does not present the bifurcation which is figured by Valentin, I, fig. 3, *F*.

The dorsal fissure (*d*) widens into the fourth ventricle about 3 mm. in front of the point where the enlargement of the medulla begins, and about 1 mm. behind the superjacent dorsal lobes. The posterior angle of the ventricle is covered by the ligula (fig. 3, *l*.)

The fourth ventricle is quite long, but, as seen in figs. 19–22, its cavity is nearly obliterated by the development of its various walls. The hinder part of the floor presents three rounded tracts

upon each side. Suggestions as to the homologies of these tracts are offered by Jackson and Clarke (15, 79), but I refrain from doing more than indicate their appearance and relative position.

Close to the median line is a rounded tract (*m t*), which is traceable anteriorly to the cerebellum; it is about 0.7 mm. in diameter. Just outside of the posterior half of this is a depressed triangular surface, the exposed border of an intermediate tract (*i t*). Outside of this, and apparently the forward continuation of the posterior border of the fourth ventricle, is a tract (*n t*) of which the mesial border, projecting over the intermediate tract, presents a series of transverse furrows with intervening nodules, on account of which I have called it the *nodular tract*. It is apparently what Owen (6, I, 273) calls the "vagal tract." The whole extent of these parts can only be seen after raising the lateral lobe, which may be done without, apparently, causing a rupture of fibres, although the attachment is quite intimate. It is then seen, as in fig. 19, that the four nodules are ganglia of origin of as many nerve roots, which, however, do not in this example project beyond the surface of the medulla.

As already stated, the lobes of the medulla are two pairs, *lateral* and *dorsal*. (See figs. 1, 2, 3, 20, 21.) These terms are here employed in a descriptive sense. The lobes may perhaps be homologized with parts of the medulla of man and of other vertebrates, but the interpretations of Owen and Valentin do not wholly coincide, and I forbear adding to the synonymy until the structure and development of these lobes have been examined among the sharks and skates; *Torpedo* and its allies would probably be very instructive.

The lateral lobe (*l l*) seems to be an enlarged continuation of the dorsal tract of the cord. Its dorsal surface is in contact with the ventral border of the dorsal lobe.

The outer surface of the dorsal lobe is somewhat rough, and, as seen from the side or from the mesial surface, presents the form of an elongated triangle with its apex backward; seen from above the apex appears rounded. The mesial surface is vertical, and closely applied against that of its lateral homologue.

As seen in fig. 20, the posterior portion of the dorsal lobe is wholly separate from the lateral lobe and the medulla; but a section farther forward, as in fig. 21, shows a line of union between its ventral margin and the mesial border of the lateral lobe.

Anteriorly, both the dorsal and the lateral lobes develop a series of folds (*l m'* and *l'*), which are continuous with each other, and thr[illegible]e transverse lamina (*c'*) with the cerebellum.

[illegible]ese folds are so complex that a complete description would be very long and difficult to follow; it seems better, therefore, to wait until their type can be ascertained from a young brain, or from comparison of the parts with those of sharks and skates.

THE CEREBELLUM (C and *c'*).—As with most Plagiostomes the cerebellum of *Chimæra* consists of two quite distinct portions, an anterior and a posterior. The anterior is a prominent inflated mass (C), the posterior is a transverse lamina (*c'*) which lies behind the other, and is only visible after dissection, as in figures 2 and 8. This posterior cerebellum is what Maclay regards as representing the entire organ, the anterior inflated portion being, in his opinion, the optic lobes.

As already intimated (page 231), the lamina may prove to be the true homologue of the simple cerebellum of Amphibia, Dipnoa, and Myzonts. Its position is well shown by Valentin (1, fig. iv. *i*), but his figure does not present one peculiarity: just upon the median line the thickness of the lamina becomes greatly diminished, as shown in my figures 2 and 8.

The anterior cerebellum (C) is an inflated oval mass resting upon the medullary lobes behind and the optic lobes in front. As seen from the side the short handle of the "hammer-formed body" is formed by upright crura (*c*), which join the base of the brain at nearly a right angle.

This portion of the base of the brain (*c c*) presents no peculiarities to distinguish it from the regions immediately in front and behind. The exposed surfaces are rounded and smooth; there is no sign of a transverse ventral commissure, or *pons Varolii*. The ventral outline of the base of the brain changes its direction at this point, and, as seen in fig. 2, its vertical thickness diminishes rapidly as it extends forward beneath the optic lobes.

The crus or peduncle of the cerebellum (*c*) measures about 3 mm. in antero-posterior width, and is 4.5 mm. high. Its hinder border is slightly overlapped by the anterior lamina of the lateral lobe. In this alcoholic specimen the exposed surface of the peduncle readily detached itself as a lamina thickest in the centre and thinner at all the borders; the plane of separation is indi-

cated by the line upon the section represented in fig. 8. The surface exposed by the detachment of the lamina is irregular.

As shown in the horizontal section (fig. 8), and the [illegible] vertical section (fig. 2), the peduncle of the cerebellum consists of an anterior and a posterior vertical lamina, which are in close apposition, and continuous by their outer borders. The anterior lamina is 2 mm. in thickness at its junction with the horizontal portion or cerebellum proper, but below becomes very thin, forming a sort of "valve of Vieussens," which is continuous with the hinder border of the optic lobes. The posterior lamina is more complex. On the middle line it is very thin; the cut surface of this median thin portion is shown in fig. 2. But on each side of the middle line it becomes suddenly very thick, as is best seen in fig. 8 (*c p*). Posteriorly the lamina becomes continuous with the vertical lamina (*o'*), which Maclay regards as representing the entire cerebellum.

Upon the exposed surface the dorsal limit of the peduncle is indicated by a curved line with its concavity looking ventrad; this also marks the line of separation of the superficial lamina already referred to.

Dorsad and in front of this is a second furrow which extends obliquely dorsad and backward from the ventral border of the cerebellum. Excepting these, and the median furrow to be presently described, the exposed surfaces of the cerebellum and its peduncles are smooth.

The expanded portion of the cerebellum is 13.5 mm. in length; about 8 mm. lie in front of the centre of the peduncle. The anterior portion also has a slight downward inclination, so that, to employ Valentin's comparison, the posterior portion is the striking part of the hammer, and the anterior is the claw.

The greatest width of the cerebellum (7.5 mm.) is just over its peduncle; it tapers quite regularly to an obtuse point before and behind, giving the whole an oval outline. Seen directly from above the posterior extremity is the sharper; but when the brain is tilted backward, as in fig. 5, the anterior extremity is more pointed.

The dorsal aspect of the cerebellum presents a median longitudinal furrow, 5.5 mm. long. Its centre lies over the centre of the peduncle. In Valentin's figure the furrow extends nearly the entire length of the cerebellum.

The ventricle of the cerebellum (*c v*) has the same general form as the organ itself, as shown in the median section (fig. 2), the transverse section (fig. 10), and the horizontal section (fig. 11).

The cerebellum of *Chimæra* presents some interesting features. It is large and its walls are thick, yet its form is simple, while those of many sharks and skates, in the adult state, are much folded. The median furrow occurs in some Plagiostomes, but is a rare feature of the cerebellum of other vertebrates.

THE OPTIC LOBES (O).—Reference has already been made (p. 230) to the view of Maclay and Gegenbaur respecting the nomenclature of these parts.

As is usually the case the form of the optic lobes is quite simple. Their size is moderate, and when the brain is viewed from above they are wholly concealed by the overhanging anterior portion of the cerebellum, as shown in figs. 1 and 3. In fig. 5 the parts are seen from above and in front so as to expose the optic lobes. The difference between the outline of the lobes in figs. 5 and 6 is thus accounted for.

The optic lobes are borne upon the crura cerebri (*c c*) already described as forming an obtuse angle with the medulla. The outer surface of each crus presents a distinct rounded elevation or protuberance (*t*), rather nearer the ventral than the dorsal border. It is shown, somewhat exaggerated, by Valentin (1, figs. 1 and 3), and called by him "*tuber cruris cerebri.*"

Measured in the direction of their greatest length, nearly parallel with the crus, the optic lobes are 8 mm. long; taken together, their greatest transverse diameter is 7 mm., which is reduced to 3.5 mm. near their hinder and more rounded end, and to 2.5 mm. near their front and compressed extremity. The median furrow, which marks the division into two lateral lobes, extends their whole length. The size and form of the ventricles and the thickness of different parts of the walls are shown by the sections represented in figures 2, 8, and 9. The cavity is smaller than in the brains of many other fishes, but not, as with mammals, contracted into an "aqueduct of Sylvius."

As seen in fig. 9 the ventricle presents four well-marked regions: two median, the upper broad and the lower narrow; and two lateral, and compressed, one upon each side, extending upward and slightly outward into the elevations upon each side of the median furrow. The lower compressed portion of the ventricle

is wider behind and in front than at the middle; hence the sides may be not improperly called the lobes of the optic ventricle (figs. 2 and 9, *o v l*). But these swellings are not necessarily to be regarded as homologous with the thickenings or involutions of the posterior walls in some Reptiles and Amphibia.

The parts already described constitute a series of median masses which may, without difficulty, be regarded as formed by the modification of a corresponding number of primary cerebral vesicles. But it is not so easy to understand how the remaining portions of the Chimæra's brain have been developed from the single anterior vesicle which, with birds and mammals, has been found to give rise to all the parts in front of the optic lobes.

These parts are the *thalami*, the *hemispheres*, and the *olfactory lobes*.

Could we trace the development of the Chimæra's brain, or had we full acquaintance with the brains of all living Plagiostomes, and of some apparently transitional fossil forms, it is probable that little difficulty would be experienced in assigning the proper limitations and names to these parts. At present our determinations and nomenclature must be largely provisional.

Concerning one pair of lobes, however, there can be very little doubt, so that it may be well to commence with them.

THE OLFACTORY LOBES (O l).—These parts, whatever their size or form, have always been identified among vertebrates by one or both of two criteria: their continuity, either direct or by crura, with the hemispheres behind; and their connection, through the olfactory nerves, with the nasal cavities in front.

In *Chimæra* the nasal cavities receive numerous nerves from the anterior surface of the most anterior pair of lobes, which may therefore be called the *olfactory lobes*.

Each lobe is a sub-quadrate mass, about 7 mm. high, and 4 mm. both in width and in its greatest antero-posterior dimension. Its junction with the hemisphere is marked by a decided constriction, which becomes a cleft at the ventral border.

With this alcoholic specimen the lobe may be readily detached from the hemisphere in a plane which is, at first, a continuation of the cleft dorsad and forward, but becomes nearly vertical at about the middle of the height of the lobe. The two facets thus exposed are slightly sunken below the border of the lobe. At about the centre of the dorsal facet is a very slight circular de-

pression (fig. 16, *o l v*); this coincides with the anterior extremity of the lateral ventricle (figs. 12, 14, 18, *l v*), and may therefore be regarded as a very rudimentary olfactory ventricle.

The mesial surface of the olfactory lobe is flat, and continuous with that of the hemisphere. The outer surface has less antero-posterior extent, because the anterior surface looks obliquely outward. The outer surface is rounded, there being a very decided depression between its most prominent portion and the most anterior elevation of the hemisphere.

The anterior surface is not only oblique, as above stated, but also divided into three distinct regions, as shown in figs. 12 and 17. The dorsal and ventral regions are nearly circular, though the transverse diameters are slightly greater than the vertical, and covered by the filaments of the olfactory nerves. Between them is a narrow, depressed area, which is devoid of these filaments. The olfactory lobes are wholly distinct from each other.

THE HEMISPHERES (H).—The parts called hemispheres with man, birds, reptiles, and batrachians have the following features, constant and common to all: 1. They are lateral masses. 2. They contain each a lateral ventricle, which communicates posteriorly with the median third ventricle through a "foramen of Monro." 3. They have no direct nerve prolongations, being connected only with the thalami behind, and the olfactory lobes in front. 4. The posterior extremities of their mesial walls are united by the anterior wall of the third ventricle—the *lamina terminalis*.

Of these four characters the first three certainly apply to the anterior three-fourths of the elongated mass, which, with *Chimæra*, lies just behind each olfactory lobe; but respecting the fourth character some qualification may be required. According to the second and fourth tests the posterior fourth of the mass cannot be regarded as a true hemisphere; the same is the case with the whole of the second pair of lobes, with Ganoids and many Teleosts, which have been usually called hemispheres, but which contain no lateral ventricle, and have, therefore, no true mesial wall.

To these pseudo-hemispheres, I have given the name *prothalami* (17, 179); and the same term may be applied to the posterior fourth of the elongated lobes of the Chimæra's brain.

Strictly speaking, the term prothalamus should be applied to

the region as a whole; each lateral moiety would then be a *hemiprothalamus*. But the shorter word may generally be used without the risk of misconception.

The length of each lobe is about 11 mm.; its height is 6 mm., and its greatest thickness 4 mm.

I am unable to determine the precise boundary line between the prothalamus and the true hemisphere. The external surface is divided by two transverse depressions into three elevated regions, of which the middle is the larger. The hindermost elevation may be said to correspond with the prothalamus.

The mesial surface presents three features which, so far as I know, have never been described—an aperture, an elevation, and a commissure. The region occupied by these corresponds very nearly with the middle elevation upon the outer surface; see figs. 1, 2, 13, 14, and 15.

The commissure is designated as *l t* upon figs. 13 and 14, but upon fig. 2 it is not marked at all. It is a flat fibrous band connecting the mesial surfaces of the two hemispheres. It was torn during the extraction of the brain, but appears to be about 3 mm. wide at its middle, and nearly twice as wide at either end. Its thickness is about 0.5 mm., the anterior and posterior borders being distinct and rounded. Its plane is slightly oblique, the anterior margin of the attachment being near the middle of the height of the hemisphere, about 4 mm. behind the olfactory suture, while the posterior margin is near the lower border. It seems safe to conclude that this commissure represents a remnant of the primitive lamina terminalis, but I am not prepared to say that it corresponds to the anterior commissure of higher vertebrates. It may be homologous with the commissure of the prothalamus in *Lepidosteus*, figured by me in 17, plate 2, but its relations to the foramen of Monro are not the same, as will now appear.

The foramen or aperture already referred to is the posterior termination of the lateral ventricle. From the section shown in fig. 15 it is seen that near the anterior termination, at the olfactory lobe, the inner and outer walls are of nearly equal thickness. But the cavity gradually approaches the mesial surface, and opens thereon about 7 mm. from the olfactory suture. This orifice forms a semicircle; the extremities are one above the other, and 4 mm. apart. The margin is distinct and rounded, though thin. The commissure is continuous with the ventral margin, but extends

2.5 mm. in front of it, and about 1 mm. behind it. The dorsal margin is continued backward and downward as a slight ridge upon the mesial surface of the prothalamus near the dorsal border.

There can be no doubt that this aperture corresponds to the foramen of Monro, or passage from the median to a lateral ventricle, but it is not easy to understand how the commissure, a part of the lamina terminalis, can extend so far in front of it.

Into the space which is nearly circumscribed by the margins of the foramen and its posterior continuations there projects a smooth convex surface, which is designated as *x* on figs. 2, 13, and 15. Its posterior border is semicircular, and a deep furrow separates it from the mesial surface of the prothalamus. Anteriorly it is continuous with the outer wall of the lateral ventricle, as shown in fig. 15. As suggested in a previous paper (17, 183, note 31), since this surface indicates a thickening of the outer wall of the ventricle, the thickening itself may be a primordial *corpus striatum*, but I hesitate to employ the term at present and would prefer to designate it as the *corpus innominatum*.

THE THALAMENCEPHALON (T).—This is the general name for all the region between the hemispheres in front, and the optic lobes behind. In most brains it is comparatively short, and presents no very characteristic features; but its extreme length forms the most obvious peculiarity of the Chimæra's brain.

With adult mammalia the region includes two irregular masses, the thalami, between which is the third ventricle; the conarium is above and the hypophysis below. With *Chimæra* the thalami themselves form three distinct regions, posterior, middle, and anterior, which I have named *basithalamus*, *mesothalamus*, and *prothalamus*.

The prothalamus. This region has already been described in connection with the hemispheres with which the two prothalami are continuous. There is reason for believing that this region exists in all vertebrate brains, and is very extensive in certain forms. This idea will be again presented at the close of this paper. I pass now to the intermediate region of the thalamencephalon.

The *mesothalamus* (*c t*). In my description of the brain of *Lepidosteus* (17, 179) this region of the brain was called *crura thalami;* the new term is to be preferred.

The mesothalamus consists of two narrow bands about 16 mm.

long, and 2 mm. in vertical diameter; their thickness is about 0.5 mm. Their dorsal and ventral borders are slightly thicker than the intermediate portion, and are inclined slightly toward the middle line so that the inner surfaces are concave, the outer convex.

The two bands may have been united by a thin ependyma, but so far as regards true nervous tissue they are separate in their entire length. Their hinder extremities arise quite abruptly from the basithalamus. Anteriorly, the mesial concavity becomes greater, but at the same time, the dorsal border presents a thinner edge which is turned *outward*. Then each band becomes continuous with the corresponding prothalamus.

The basithalamus (*b t*). This name is given to the depressed and constricted part just in front of the optic lobes, of which it forms a kind of neck. It may be said to be bounded by two imaginary lines, the one passing just in front of the optic lobes and the protuberance upon the underlying crus, the other passing from the most anterior border of the optic lobe in front of the chiasma. The triangular outer surface thus bounded represents the optic tract, the expanded nerve passing upward and backward to the optic lobe of each side. The basithalamus seems to correspond to the hinder part of the thalami with air-breathing vertebrates.

The cavity of the basithalamus is a slender rounded canal, the forward continuation of the optic ventricle. Anteriorly this canal curves upward, and opens through the foramen of the thalamus (fig. 5), just above the chiasma. This foramen is not rounded, but quadrangular, the angles projecting vertically and laterally. From above the orifice is concealed by a pair of thin horizontal plates (figs. 1, 2, 5, *t l*) which are attached to the anterior border of the optic lobes, and united by the posterior fourths of their mesial borders. This double cover is not represented by Valentin, and seems not to have been noticed in the brains of other fishes; but I have found it, under one form or another, in all ganoid, teleost, and plagiostome brains so far examined. It seems to be the reduced representative of the posterior part of the roof of the third ventricle with Amphibia and Myzonts; if so, we should name it *posterior commissure*.

The conarium. With Amphibia this part lies just above the foramen, closing it, in fact; still it not infrequently is removed

with the roof of the brain cavity; with most Plagiostomes it is in close contact with the roof, and this was probably the case with *Chimæra*, since the conarium of this example is wanting. A depressed quadrangular space is left upon the median line between the contiguous margins of the optic lobes and the cover above described.

The hypoaria (*h*). As seen in figures 1, 2, and 4, beneath the basithalamus is a rounded mass, consisting of a pair of oval lobes, with a triangular median surface between their hinder portions. These are apparently the parts called by authors *hypoaria*, or *lobi inferiores;* they may correspond to the *tuber cinereum* of anthropotomy, but the homology of the parts of this region of the brain is not yet well determined.

Each lobe is about 6 mm. long, and about 4 mm. wide. They are hollow; their cavities communicate with each other, and, through a vertical passage, with the ventricle of the basithalamus. On the median line the triangular space between the hinder portions of the lobes presents a fissure about 3 mm. long, by which the cavity of the hypoaria opens externally.

Below the corresponding fissure in the brains of *Lepidosteus* and other fishes is a globular mass, apparently vascular, which may represent the hypophysis. No such mass was found in this specimen, but it may have been lost through inadvertence. As above intimated, the homology of these parts is not yet understood.

The optic nerves (*o n*) are about 1 mm. in diameter, excepting just before their union to form the chiasma; here they increase in width, and then become constricted. The dorsal borders of the enlargements are slightly overlapped by the mesothalami.

The *optic chiasma* (*o c*) is very compact; but I have not examined its structure.

Morphological Considerations.—Whatever may be the peculiarities of the hinder regions of the brain of *Chimæra*, there appears to be a close homology between them and the hinder regions of the brains of most sharks and skates; the latter, therefore, as more accessible, should be employed for the determination of the structure, and mode of development of the medulla, cerebellum, and optic lobes.

But the ordinary Plagiostome brain seems to throw no light upon the study of the remaining divisions of the chimæroid brain,

and some features of the latter seem to be exaggerations of the characters of certain Ganoids. In the brain of *Scymnus lichia*, however, as figured by Mayer (5, taf. 1, fig. 7), there are indications of a transition between the plagiostome and chimæroid types, and I would urge upon any anatomist who may have the opportunity, the need of a careful examination of its brain. Still more desirable is the discovery of very young examples of *Chimæra*.

I think that I begin to see, though still dimly and imperfectly, the method by which the close homology of the parts in front of the optic lobes can be demonstrated.

The first, and most essential, step in this demonstration seems to me to be the recognition of the distinctions between a *hemisphere* and a *prothalamus*. The former is a *lateral* mass containing a ventricle. The latter is, strictly speaking, a *median* mass inclosing the anterior portion of the third ventricle, which opens laterally into the hemisphere ventricles through the foramina of Monro. Its anterior boundary is the lamina terminalis. In sharks and skates the prothalamus persists as the hinder part of the nearly solid mass in front of the optic lobes. The true hemispheres project forward to a greater or less extent, as shown in a previous paper (27). This median mass also persists in *Ceratodus*, although Prof. Huxley calls it *lobus communis* (16, 30). With *Chimæra* the lamnia terminalis is reduced to a slight commissure, and the outer walls of the prothalamus, almost disconnected, become lateral solid masses, the *hemiprothalami*. The true hemispheres persist, with their lateral ventricles. But with Ganoids and Teleosts the hemispheres seem to be rudimentary, and their name has been usually applied to the hemiprothalami. The mesothalami may be more or less elongated in various genera.

With the air-breathing vertebrates the hemispheres are prominent, and the prothalamus correspondingly reduced. But I think its ventricle can be recognized in all, especially embryos, as the space bounded in front by the lamina terminalis, and opening laterally through the foramen of Monro. A more extended consideration of this matter must be reserved for a separate paper.

TAXONOMIC CONSIDERATIONS.—The views of Müller, Valentin, and Mayer respecting the affinities of the Holocephala are given in the historical sketch. Gegenbaur (14, 408) makes the group of equal value with Teleosts, Ganoids, and Selachians [Plagiostomes].

Huxley, in speaking (16, 41) of Müller's separation of the Holocephala, expresses himself as follows:—

"It appears to me that he might have been justified in going still further; for, considering, in addition to the cranial characters, the structure of the vertebral column, and of the branchiæ, the presence of an opercular covering to the gills, the peculiar dentition, the almost undeveloped gastric division of the alimentary canal, the opening of the rectum quite separately from and in front of the uro-genital apertures, the relatively small and simple heart, the Chimæroids are far more definitely marked off from the Plagiostomes than the Teleostei are from the Ganoids."

I have only to add, upon the present occasion, that the conclusion which Prof. Huxley bases upon the consideration of other parts of the organization, seems to me fully confirmed by the structure of the brain of *Chimæra*, as described in the foregoing pages; the Holocephala seem to differ from the Plagiostomes more than the Ganoids differ from the Teleosts, and should form a primary subdivision of the fish-like vertebrates, like the Amphibia, Dipnoi, Ganoidei, Teleostei, Plagiostomes, and Myzontes or Marsipobranchs. (See, also, pages 227 and 228.)

List of Papers and Works referred to.

1. Valentin. Ueber das centrale Nervensystem und die Nebenherzen der Chimæra monstrosa. Archiv für Anatomie, 1842; 25–45, Taf. II.

2. Müller Johannes. Remarks upon the foregoing paper of Valentin. Bericht über die Fortschritte der vergleichenden Anatomie der Wirbeltheire in Jahre, 1843. Archiv für Anat., 1843; CCLIII.

3. Busch. De selachiorum et ganoideorum encephalo. 4to. 1848.

4. Vulpian. Leçons sur la physiologie générale et comparative du système nerveux. 8vo., pp. 20. Paris, 1861.

5. Mayer, F. J. C. Uber den Bau der Gehirns Fische in beziehung auf eine darauf gegründete Eintheilung dieser Thierklasse. Mit sieben steintafeln. pp. 40. Novorum Actorum * * * Naturæ Curiosorum. Tom. Vicesimus Secundus. 1864.

6. Owen, Richard. Comparative anatomy and physiology of vertebrates. 3 volumes, 8vo.; pp. 2155, 1471 figures. London, 1861-68.

7. Miklucho-Maclay. Beitrag zur vergleichenden Anatomie des Gehirns; pp. 19, 3 fig. Jenaischen Zeitschrift für Medicin und Naturwissenschaft. 1868.

8. Miklucho-Maclay, and Gegenbaur. Ueber den Bau des Gehirns des Chimera monstrosa. Jenaische zeitschrift, 1869, V. heft 1. [Abstract in Journal of Anat. and Phys., 1869, iv. 163.]

9. Panceri and de Sanctis. Sopra alcuni organi della Cephaloptera. Napoli, 1869, 4to.

10. Miklucho-Maclay. Beiträge zur vergl. Neurologie der Wirbelthiere. I. Das gehirn der Selachier, mit sechs Tafeln. II. Das mittelhirn der Ganoiden und Teleostier, mit einer Tafeln. 4to. Leipzig, 1870.

11. Rolleston, George. Forms of animal life; being outlines of zoölogical classification based upon anatomical investigation and illustrated by descriptions of specimens and figures. 8vo. pp. 436, 12 plates. Oxford, 1870.

12. Gegenbaur, Carl. Ueber die cranialnerven des Hexanchus. Jenaische zeitschrift, 1871, VI., 497.

13. Huxley, T. H. Manual of the comparative anatomy of vertebrated animals. 16mo., pp. 431, 110 figures. New York, 1872.

14. Gegenbaur, Carl. Grundriss der vergleichende Anatomie. 8vo., pp. 406, 320 figures. Leipzig, 1874.

15. Jackson, W. H., and Clarke, W. B. The brain and cranial nerves of Echinorhinus spinosus, with notes on the other viscera. Journal of Anat. and Phys. Oct. 1875; X. 75–197, pl. VII.

16. Huxley, T. H. Contributions to morphology. Ichthyopsida.—No. 1. On Ceratodus Forsteri. Proc. Zool. Soc. London, Jan. 4, 1876.

17. Wilder, Burt G. Notes on the American Ganoids, Amia, Lepidosteus, Acipenser, and Polyodon. Proc. Am. Ass. Adv. Sci. 1875. 148–189. 3 plates.

18. Stieda, Ludwig. Untersuchungen über das Centralnervensystem der Knochenfische. Siebold und Kölliker's Zeitschrift, 1867, XIII., 1 et seq.

19. Günther, Albert. Catalogue of fishes in the British Museum. 8 volumes, 8vo., 1859–70.

20. Owen, R. Description of Lepidosiren [Protopterus] annectens. Linnæan Transactions, xviii. 327-361, 5 plates.

21. Duméril, Aug. Historie naturelle des poissons ou ichthyologie générale. Tome I. Elasmobranches [sharks, skates, and chimeræ], pp. 720, 14 plates. 1865. Tome II. (Ganoides, Dipnés, Lophobranches), pp. 625, 12 plates. 1870. Paris, 8vo.

22. Foster and Balfour. The elements of embryology. Part I. History of the Chick. Crown 8vo., London, 1874.

23. Müller, Johannes. Vergleichende anatomie der Myxinoiden, und der Cyclostomen, mit durchbohrten Gaumen. Abhandlungen der Königl. Akad. der Wissenschaften zu Berlin, 1834 (publ. in 1836); 65-340, 9 plates.

24. Wilder, B. G. On the brains of some fish-like Vertebrates. Proc. Am. Ass. Adv. Sci., 1876; pp. 10, 1 plate.

25. Huxley, T. H. On the constancy of origin of the fourth pair of nerves as an argument for the commonly accepted determination of the cerebellum and optic lobes of sharks and skates. Unpublished remarks upon the preceding paper, at the meeting of the Am. Ass. Adv. Sci., at Buffalo, N. Y., Aug. 25, 1876.

26. Balfour, F. M. The development of elasmobranch fishes. Journal of Anatomy and Physiology, 1876; x., 377-411, plates x. and xvi; 517-570, pl. xxi.-xxvi.; 672-683, pl. xxix.

27. Wilder, B. G. Note on the development and homologies of the anterior brain mass with sharks and skates. Am. Journal of Science, Aug. 1876, xii., 103–105, 3 figures.

Explanation of Figures.[1]

Figures 1, 2, 4, and 15 are natural size. The remainder are enlarged two diameters.

Fig. 1. Brain of *Chimæra monstrosa*, ♂, from the left side.

Fig. 2. The brain is cut vertically and longitudinally on the median line so as to show the mesial surface of the right half.

Fig. 3. View of the hinder region, from above.

Fig. 4. The same region from below.

Fig. 5. The same region from above and in front, so as to show the optic lobes and the parts in front of them. The cerebellum is foreshortened.

Fig. 6. The optic lobes from above.

Fig. 7. The anterior portion of the medulla, showing parts which are naturally covered by the crebellum.

Fig. 8. Horizontal section of the optic lobes, the peduncles of the cerebellum, and the anterior portion of the medulla.

Fig. 9. Transverse section of the optic lobes in the direction of a line drawn from the anterior extremity of the cerebellum to the posterior margin of the hypoaria.

Fig. 10. Vertical transverse section of the cerebellum between the anterior and posterior laminæ. The corresponding portion of the medulla is not shown.

Fig. 11. Horizontal section of the cerebellum, showing the interior from above.

Fig. 12. Outer surface of the left anterior region, olfactory lobe (separated), hemisphere, prothalamus, and part of the mesothalamus.

Fig. 13. The same (exclusive of the olf. lobe) from above.

Fig. 14. The same from below.

Fig. 15. The same in horizontal section.

Fig. 16. Left olf. lobe, showing the surface by which it was attached to the hemisphere, and the slight depression which constitutes the olf. ventricle.

Fig. 17. The same, showing the anterior surface.

[1] figures were drawn from nature, and on stone, by Miss G. D. student in the Natural History course at Cornell University.

. 18. The anterior surface of the hemisphere corresponding e surface shown in fig. 16.

Fig. 19. The medulla after removal of the dorsal and lateral lobes so as to show the roots of the vagus.

Fig. 20. Transverse section of the medulla near the hinder end of the lobes.

Fig. 22. The same in front of the nerve roots.

Fig. 23. Transverse section of the spinal cord. (These three figures are mainly diagrammatic, proper microscopic sections not being available.)

Expla Signs.

The names of the prin ns are indicated by capitals, as follows:—

S C, spinal cord.
M, medulla oblongata.
C, cerebellum.
O, optic lobes.
T, thalamencephalon.
H, hemispheres.
O l, olfactory lobes.

The following are designations of the subdivisions arranged under their respective divisions. The numbers indicate the figures in which the parts are shown.

S C, spinal cord.

v, (4, 20, 21, 22) ventral (anterior) median fissure.
d, (3, 22) dorsal (posterior) median fissures.
v c, (4, 22) ventral columns.
d c, (1, 3, 22) dorsal column.
v l, (4, 22) ventral lateral line.
d l, (1, 3, 22) dorsal lateral line indicated by a series of nerve roots.
l c, (1, 22) lateral columns.

M, medulla oblongata.

IV, (2, 3, 20, 21) fourth ventricle.
l, (2, 3) ligula.
n o, (1) origins of nerves.
r, (1) restiform bodies, continuations of the posterior columns.
m l, (19, 20) median tracts seen in the fourth ventricle.

i t, (19, 20) intermediate tracts.
n t, (19, 20) nodular tracts.
v r, (19, 20) roots of vagus nerve.
d m, (1, 2, 3, 20, 21) dorsal lobes of medulla.
d m', (1, 3, 5, 7) anterior convoluted portion of the same.
l l, (1, 20, 21) lateral lobes of medulla.
l l', (1, 3, 4, 5, 7, 8) anterior convoluted portion of the same.

C, cerebellum.
c, (1) crus or peduncle of the cerebellum.
d f, (3, 5, 10) dorsal furrow.
c a, (2, 8, 11) anterior lamina.
c p, (2, 8, 11) posterior lamina.
i f, (11) furrow on anterior surface of posterior lamina.
c', (2, 8) posterior cerebellum.
c v, (2, 8, 10, 11) ventricle of the cerebellum.
i, (2) communication between the fourth ventricle and the cerebellar ventricle.

O, optic lobes.
c c, (1, 2, 9) crura cerebri supporting optic lobes.
t, (1, 5, 9) protuberance upon the crus cerebri.
o v, (2, 8, 9) optic ventricle, median and larger portion.
o v', (9) median ventral portion.
o v'', (9) lateral dorsal portions.
o v l, (2, 9) lobes of the optic ventricle.
o v p, (2) constricted communication of the optic with the cerebellar ventricle.
o v a, (2) constricted communication with the third ventricle.

T, thalamencephalon.
b t, (1, 2) basithalamus.
h, (1, 2, 4, 5) hypoaria, or lobi inferiores.
h v, (2) ventricle of the hypoaria.
h f, (4) fissure of the hypoaria.
t c, (2) canal continuing forward from the optic ventricle; really part of the third ventricle.
t f, (5) foramen of the thalamus.
t l, (1, 2, 5) double cover over the foramen.
o c, (2, 4) optic chiasma.
o n, (1, 2, 4) optic nerves.

c t, (1, 2, 3, 4, 5, 12, 13, 14) mesothalamus.

p t, (1, 2, 12) prothalamus.

H, hemisphere.

f m, (2, 13, 15) foramen of Monro.

l v, (14, 15, 18) lateral ventricles.

x, (2, 13, 15) rounded thickening of outer wall of ventricles.

l t, commissure of the hemisphere (lamina terminalis).

O l, (1, 2, 12, 16, 17) olfactory lobes.

o l s, (2) suture between hemispheres and olfactory lobes.

o l v, (16) rudimentary olf. ventricle.

o l n, (17) two groups of olf. nerves.

ON THE ROCKS NEAR PHILADELPHIA.

BY THEO. D. RAND.

In pursuit of the study of Mineralogy I have become somewhat acquainted with the rock formations near Philadelphia, and have thought some of the observations of sufficient interest for publication, that others, possessing more knowledge, may apply them towards a solution of the geology of the region. Specimens of many of the rocks to which I refer will be found in the collection recently given to the Academy. I have endeavored to trace the rocks along their outcrop, and will consider them in their order at the Schuykill, beginning at Gray's Ferry.

From that point to Girard Avenue Bridge, Mica Schists with beds of gneiss occur—the gneiss including granitic veins and the following minerals: Muscovite, Orthoclase, Albite, Tourmaline, Garnet, Beryl, Lime Uranite, Copper Uranite, and Sulphide of Bismuth (Bismuthinite). This is most fully developed at Fairmount. There is a striking resemblance between these rocks and those of the vicinity of Chester, Delaware Co., in which all the above minerals occur, except the Bismuthinite. Carbonate of Bismuth, Bismutite, however, does occur.

On the west bank of the river above Girard Avenue is a mass of coarse granite, in which the characteristic minerals are Muscovite and Biotite intercrystallized. A similar granitic rock appears at several points along the ridge west of the creek known as Mill Creek, in the vicinity of 44th Street, West Philadelphia, and particularly at a point on the Baltimore turnpike in the same vicinity, as observed by Prof. Kœnig and Mr. H. C. Lewis.

Above the Columbia Bridge there is a peculiar gneiss of a reddish color, and near by efflorescences of Halotrichite. More abundant is a hornblendic gneiss at South Laurel Hill.

This belt appears to cross Belmont Avenue above George's Hill, and the Penna. R.R., about half way between 52d Street and Overbrook. A deep cutting exposes the rock, which there abounds in Pyrites, and which in part is very compact. Much of this rock completely decomposes within two or three years after exposure.

At the Falls, a belt of very hard porphyritic gneiss crosses the river, forming the N. W. flank of Laurel Hill, and the S. E. bank

of the river, and seems to have caused the abrupt bend at this point. This belt is very narrow at the Schuylkill, only from one hundred to two hundred feet in width, but it widens as it goes southwestward. The lower edge is crossed by the Pennsylvania Railroad less than a quarter of a mile from the rocks last described, the upper at Elm Station, six miles from the city—a distance along the railroad of nearly two miles, but across the strike probably about one and a quarter. This rock is so hard that its outcrop can be almost continuously traced.

At Flat Rock Tunnel, on the Schuylkill, seven miles above Fairmount, a bed of hard mica schists and gneiss crosses the river—this is probably the continuation of the beds so largely wrought for building stone at Frankford, and crossing Wayne Street, Germantown, near the railroad, and the Wissahickon at McKinney's quarry, there causing the abrupt bend in the stream. The minerals of this belt are particularly zeolites, chiefly Stilbite, also Muscovite, Biotite, Orthoclase, Albite, Sphene, Calcite, Apatite, Epidote, Copper Pyrites, Chrysocolla, etc., and Molybdenite. The quarries at Frankford having been most extensive, all these minerals have been found there, nearly all of them at McKinney's, and only the Zeolites, Calcite, Muscovite, Orthoclase, and Albite at the Tunnel. The identity of the rock to McKinney's is, I think, unquestionable, and the continuation at the Tunnel probable.

About two miles above, passing mica schists, sometimes filled with garnets, we reach the well-known Soapstone belt, which extends in a straight line, most clearly marked, from a point on the west flank of Chestnut Hill, about S. 54° W. This belt was supposed to dip under, near Merion Square, at the "Black Rocks," but Prof. Booth called my attention to its appearance at Rosemont Station, Penna. R.R., ten miles from Philadelphia. Its characteristic rock is the so-called bastard soapstone, a paste of Steatite, filled with irregular masses, and occasionally crystals, of Serpentine, probably, as I have heretofore shown, pseudomorphic after Staurolite. This same rock, with the cystals well defined, I have observed on the road from Philadelphia to West Chester, ten and a half miles from Philadelphia, the belt in which Moro Phillips' Chrome mine has been opened.

West of this, at the Schuylkill, and apparently on the S. W. bank only, is a bed of slaty serpentine, very dark olive-green, and sometimes almost black in color, associated with a mineral resem-

bling Schiller Spar, and also an almost unaltered hornblendic mineral, apparently Enstatite. This belt is narrow, but very well defined, with frequent outcrops. It cuts diagonally, but at a very small angle, the rocks next described, and continues in a course W. 5° N., on their north flank, and is almost without doubt continuous with the well-known belt just north of West Chester. Its outcrop is frequently marked by cellular quartz with cavities lined with crystals, and stained by oxide of iron. At one point, one-quarter mile S. W. of Radnor Station, Penna. R.R., twelve miles from Philadelphia, at the side of an old quarry, the mode of formation of this rock from the Serpentine is shown in a remarkable manner. At the bottom, the serpentine is almost unaltered, above, cracks are seen extending through it in various directions, but usually one series nearly parallel and more or less at right angles to another, higher still; these cracks are seen to contain films of quartz, which become thicker and thicker, while the inclosed serpentine is softer and more rusty in color, until, near the top, the cells have thick walls, and contain only a small amount of what appears to be oxide of iron, and in part are empty. Well waters in the vicinity contain magnesia and iron, and sulphuric and silicic acids.

At Spring Mills, a bed of gneiss and granite, or granitoid gneiss crosses the Schuylkill. These are very hard rocks, and form the highest summits of the table-land, of which they form the N.W. boundary. The stratification is nearly vertical, and the characteristic mineral is a bluish quartz, which weathering out of the rock is everywhere visible in the roads. Taking this as a criterion, these rocks extend from above Van Arsdalen's quarry, in Bucks Co., at least to Darby Creek. The gneiss is often hornblendic, sometimes porphyritic, and generally composed of thin layers of alternately light and dark material. It seems entirely destitute of granitic veins or of crystalline minerals, except those composing the mass of the rock quartz feldspar—probably both orthoclase, and a triclinic feldspar, hornblende and mica.

At the Schuylkill, immediately northwest of this, is a small limestone valley, and then the continuation of the Edge Hill rocks. On the northeast side of this valley stretches a narrow dyke of trap almost continuously exposed for many miles, crossing the Schuylkill at Conshohocken, and the Penna. R.R. and the Lancaster turnpike at Wayne, thirteen miles from Philadelphia: there is

also an exposure of trap in a cutting of the Pennsylvania R.R. through the granitic belt northeast of Radnor Station. This is not in line with any other trap dyke of which I have knowledge.

The Edge Hill rocks form a ridge at the Schuylkill not over a quarter of a mile in width, but rapidly widening, until between Radnor Station and the King of Prussia they are over a mile and a half wide. They are composed of talc-like schists, but are probably hydro-mica schists, in nearly vertical strata, with beds of quartz with cavities which appear to have contained pyrites, much resembling the auriferous quartz of the Eastern United States. This ridge or table-land, which is quite steep in its slopes, forms the southeast boundary of the Chester Valley.

A remarkable feature of the part of Montgomery Co. and Chester Co. bordering on the Schuylkill is the direction taken by the streams. The general features are high hills extending in a N.E. and S.W. direction with deep limestone valleys between, nearly at right angles to the general course of the Schuylkill. The streams, however, do not follow the valleys. The Wissahickon leaves the Montgomery Co. valley and flows eastwardly through a deep narrow gorge through very hard rocks a distance of over five miles. The Valley Creek flows down the Chester Valley and then turns abruptly westwardly and flows through the N.W. boundary hill. The Gulf Creek flows down the valley two or three miles, then turns westwardly and flows through a deep and narrow gorge into another valley on the west, with banks rising abruptly two or three hundred feet.

NOTES DESCRIPTIVE OF A STONE MOUND AND ITS CONTENTS.

BY JOHN FORD.

A few years ago Mr. E. P. Ford, of Piasa, Ill., a careful student of American archæology, and a valued friend and relative of the writer, became the owner of a tract of timber land bordering on Coup's Creek, a small stream that forms the northern boundary of Brown's Prairie, Macoupin County, Ill.

A group of eight burial mounds lying within the borders of this ground had remained undisturbed prior to its purchase by Mr. Ford.

These were located upon the crest of a ridge which rose some fifty feet or more above the creek level, and about one hundred yards from its northern bank.

They were ranged in a line nearly parallel with the stream, the diameter of each being about thirty feet, and the distance between their respective bases upwards of fifty.

When discovered by Mr. Ford, all but one, the fourth, numbering from east to west, were comparatively hidden by a heavy growth of timber and brushwood.

The absence of vegetation upon the exceptional one suggested the probability of its being what is locally termed a stone mound, and the work of opening it was immediately begun.

About eighteen inches below the surface, and near the centre of the mound, a stone slab was struck, and subsequently two others. These being cleared and lifted, revealed a grave or vault which measured twelve feet in length by four and one-half feet in width, with sufficient depth to permit a man to sit upright. It was constructed of stone plates or slabs throughout, a few of them being quite large, and squared on the edges. The covering was composed of the three largest, while the next in size formed the vertical walls, which were braced upon the outside by others set firmly against them at an angle of forty-five degrees. The floor, which had been sunken somewhat below the original surface, contained a few small slabs, but was more especially composed of a sort of rubble-work. This was only four or five inches in thickness, but very hard and as dry as powder.

From some cause, whether by the action of friends of the dead,

by worms, or the percolation of water, it appeared impossible to explain, the entire space between the walls of the grave, not occupied by bones, was packed with a peculiar, granulated, but exceedingly tenacious earth. Owing to the dense character of this earth but little progress was made at the time, beyond ascertaining that a grown person had been placed in a sitting posture in each corner of the grave, all facing eastward; while between them the bones of perhaps twenty others were mingled together indiscriminately. Nearly all of the latter had been broken previous to interment, and it was particularly noticeable that the left sides of the skulls accompanying them had in every instance been crushed by a blow from some blunt weapon, while the remaining portions had been left in perfect condition.

Carefully replacing the covering slabs, and leaving the contents of this grave for future examination, a search was made on the slope of the mound for others. Two smaller ones were soon discovered, each built of the same kind of material and in the same manner as the central one. The smaller of these, measured between the walls, was three feet long by eighteen inches wide, and was, doubtless, the grave of a child, the white lines made by the bones being easily defined in the dark surrounding earth.

A portion of this grave, and nearly the whole of the largest one, was subsequently (in October, 1875) excavated and examined by Mr. Ford and myself, and we had every reason to believe that these, together with the third one in which the skull and shells accompanying this paper were found, had been constructed at the same period of time and by the same people.

The scene presented upon opening the third grave was somewhat novel if not startling in character. Four skeletons sat within it, two and two; their arms crossed, the knees of one pair pressing sharply against the backs of the other, and the faces of all (like those in the central grave) turned directly toward the east. The enveloping earth was not so dense, or the quantity so large in proportion, as in the other graves; so that most of the upper parts of the skeletons were exposed upon lifting the covering slab.

At first it was supposed that the skulls of all could be safely removed; but though the greatest care was taken in the operation, only one specimen, which has been presented to the Academy, was secured in a comparatively perfect condition.

Although this grave measured but six feet in length by three in width, there was little doubt among the party that it contained relics other than those of a human character. A careful search revealed nothing, however, except four large marine shells, the *Busycon perversum*, of Linnæus. The position of each of these in relation to the bodies was the same. The canal or smaller end of one had been placed in the right hand of each individual, while the larger portion rested in the hollow above the left hip. But more remarkable than this was the fact that within each of the shells there had been packed what appeared to be the bones of a child; the skull, which evidently had been crushed before burial, protruding beyond the aperture. Of course, any hypothesis regarding the purpose of this peculiar rite must necessarily be of a conjectural character; nevertheless, it was difficult to resist the conclusion that these infants were sacrificial offerings to the spirits of the dead whom the living desired to honor.

None of the mounds comprising the series under consideration exceeded three feet in height, though several others opened in the vicinity, and in the adjoining county of Jersey, during my visit, rose from five to ten feet above the surrounding level. Nothing was found in them, however, save some broken pottery and a few decaying bones.

After much search, the bluff or quarry from which the slabs had been split was discovered by Mr. Ford, about three-fourths of a mile west of the mounds. The rock is quite hard, somewhat fossiliferous, and probably belongs to the upper carboniferous series.

Whatever may be the facts regarding the origin, degree of civilization, etc., of the mound-building race, it is highly probable that they were a people of fixed habits, possessing decided constructive ability, and subject alike to order and system in their daily avocations.

Evidences of an undoubted character go to show that they were careful cultivators of the soil, and it is no uncommon belief among the thinking men of the Southwestern States that the small prairies so numerous in that section owe their present tillable condition, if not their origin, to the indefatigable labors of this "eminently agricultural people."[1]

These prairies are skirted almost invariably by beds of streams and belts of growing timber, and it was chiefly upon the bottom

[1] Albert Gallatin.

lands adjoining the one and the ridges inclosed by the other that the mounds were constructed. As a rule, those nearest the water level in the region examined by us were mere foundations for dwellings, while those for burial and defensive purposes appear to have been built exclusively upon the ridges. It was also noticed that the burial mounds occupied a position upon the nearest ridge directly northeast of the village proper, while those for defensive purposes were located principally upon the most favorable points northwest of the same.

Mr. Ford informed me that he had observed this peculiar disposition of the mounds at many other points besides those we had visited together, and that, so far as he had been able to ascertain, the same systematic arrangement prevailed along the whole of an irregular line (that may have been an ancient highway), extending from the foot of Lake Michigan to the mouth of the Illinois River, a distance of about two hundred and fifty miles.

The great antiquity of the mounds is indicated by the condition of their contents. Though vast numbers of them have been opened, the relics found therein have been much the same; a handful of bones or a skeleton that crumbled at the touch, with here and there an ornament or weapon, some broken pottery, or a solitary marine shell. Rarely, indeed, has a skeleton been discovered in a condition suitable for intelligent examination, while, until very recently, but one perfect skull belonging incontestably to the mound-building race, has been secured, and that one was taken from a mound in the Scioto Valley, near Chillicothe, Ohio.[1]

[1] Squier and Davis, *vide* Baldwin's A. A., page 48.

JUNE 5.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "Additional Notes on Bassaricyon Gabbii," by Joel Asaph Allen, was presented for publication.

JUNE 12.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

The deaths of Amable J. Brazier, member, and Philip P. Carpenter, correspondent, were announced.

Remarks on some Parasitic Infusoria.—Prof. LEIDY remarked that most of the known parasitic infusoria possessed a mouth, as in those which lived free in the waters. Such is the case with the species of *Balantidium* found in the intestinal canal of man, the hog, and various batrachians; of *Nyctotherus*, found in the intestine of frogs, several insects and myriapods; and the *Conchophthirus anodontæ*, often found abundantly on the branchiæ and palpi of our *Anodon fluviatilis*.

Other parasitic infusoria are not only devoid of an intestinal canal as characteristic of their class, but have no mouth, and, like the tapeworms and Echinorhynchi, absorb nourishment through the exterior surface of the body. Such is the case with the genus *Anoplophrya* of Stein, typified by the *Anoplophrya lumbrici*, found in the intestine of our common earthworms, as well as in those of Europe. Prof. Leidy had also detected the same species in the little wood-worm, *Enchytræus socialis*, and had found two other species, formerly described by him under the names of *Leucophrys clavata* and *Leucophrys cochleariformis*, in the intestine of *Lumbriculus limosus* and *L. tenuis*.

Recently in dissecting the fresh-water snail, *Paludina decisa*, while examining the branchiæ he observed several individuals of an *Anoplophrya* moving actively, as if in antagonism with the ciliary motion of the branchial plates. Seeking the source of the little creatures he found that they came from the rectum of the *Paludina*. In examining other individuals of this snail he observed that some were free, others were infested with few, and some with multitudes of the infusorian. In several instances the *Anoplophryæ* were so abundant as to resemble in their crowded condition

a mass of writhing worms, actually distending the portion of the intestine they occupied. The species appears to be an undescribed one, and is interesting from its comparatively large size. It was named and described as follows:—

ANOPLOPHRYA VERMICULARIS.—Body cylindrical, slightly tapering posteriorly, rounded at the extremities, or subacute behind; flattened at the anterior extremity; translucent white, finely striated longitudinally, uniformly clothed with short cilia; internally finely granular, with a longitudinal cylindrical nucleus occupying nearly the length of the axis, and with from twenty to thirty contractile vesicles, mostly arranged in one, but often in two longitudinal series. Length from two-fifths to one-half a millimetre; breadth in front .044 to .048 mm., behind .032 to .04 mm.

Besides the movements of progression induced by the cilia, the animal wriggles in a sigmoid manner and even doubles on itself. The contractile vesicles may contract more or less successively to mere points, but apparently at no time entirely disappear, and they may enlarge to double their usual size. The axial nucleus is at first barely perceptible, but becomes very obvious as the animal approaches dissolution.

Incidentally Prof. Leidy also stated that *Aspidogaster conchicola*, so common in the pericardium of Anodonta and Unio, he had also found in one instance in the oviduct of *Paludina decisa*.

JUNE 19.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

Remarks on the Seventeen-year Locust, the Hessian Fly, and a Chelifer.—Prof. LEIDY remarked that he had returned last evening from a short visit to Easton. He stated that the Seventeen-year Locust, *Cicada septendecim*, had made its appearance in the vicinity of that town. He further stated that the wheat in the same locality was seriously affected by the Hessian Fly, *Cecidomyia destructor*, which has now passed into the puparium stage. In one field examined half the crop was destroyed by the insect. He further remarked that his little daughter brought to him an Elater, *Alaus oculatus*, and, on her account professing to attach some interest to a common insect, in examining it with more than usual attention, he was surprised to find concealed beneath the elytra six Chelifers. He was not aware whether the Elater was commonly infested in this manner. In another specimen subsequently found, there were no Chelifers. The Book-scorpion, *C. museorum*, appears not to be common with us, as he rarely met with it. He had occasionally met with another species, perhaps

C. cancroides, attached to the House-fly. The *Chelifer* of the Elater is different from either of those just named, and is perhaps an undescribed species. Its characters are as follows:—

CHELIFER ALIUS.—Body in general chestnut-brown; the pedipalps and the dorsal shield of the cephalothorax being darkest; the abdomen lightest, and in the largest individuals, probably females, whitish with transverse dorsal and ventral bands of brown. Body with the sides nearly parallel, but widening slightly posteriorly; being widest near the termination of the abdomen, except in the largest female, in which it is widest near the middle of the abdomen. Maxillary palps shorter, or not longer than the body; intermediate joints of the same about twice the length of their thickness. Length of body from $1\frac{1}{2}$ to $2\frac{1}{2}$ mm.; length of pedipalps from $1\frac{1}{2}$ to $1\frac{9}{10}$ mm. All parts are hairy, but the abdomen of the largest ones is less so than in the others.

The species bears much resemblance in form and color to the *C. Reussii*, Koch. It also resembles the *C. americanus*, De Geer, but does not possess the knob on the penultimate joint of the pedipalp.

JUNE 26.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

The Birth of a Rhizopod.—Prof. LEIDY remarked that while it was a matter of common observation that the naked Rhizopods, like *Amœba*, and *Actinophrys*, multiply by division, the manner in which the test-bearing forms were produced was not so obvious.

Many instances are recorded in which observers, beginning with Le Clerc, who first described a *Difflugia*, have noticed pairs of individuals attached by the mouths of their tests. In these instances the animals have generally been supposed to be in copulation, or conjugation as it is commonly called, and perhaps such is often the case. It has also been repeatedly noticed in many cases that of the two individuals in conjugation one was somewhat smaller and more delicate, and if it were a colored species, it was paler than the other. Little significance usually has been given to this difference.

Claparede and Lachman (Etudes sur les Infusoires, 1859, 445) have viewed such cases of the supposed conjugation of *Arcella*, as simply the formation of a new test to accommodate the contents of an old one which had become too small.

Bütschli (Archiv f. Mikr. Anat. 1875, 459), after observing the supposed conjugation of *Arcella*, noticed within the test free moving *Amœbæ*. These he supposed were the brood of the former, but after having seen them escape from the test, he failed to trace their further course.

Cienkowski recently (Archiv f. Mikr. Anat. 1876, 41) described the mode of multiplication of *Chlamydophrys stercorea*, in which he observed the animal to protrude from its test a mass of sarcode, which, assuming the size, form, and structure of the parent, became detached from it as an independent individual. He remarks that this procedure for Rhizopods is not new, and has been indicated by Cohn and others, in *Arcellæ*, as copulation.

Prof. Leidy continued: I have repeatedly observed different species of *Difflugia*, *Hyalosphenia*, *Nebela*, *Euglypha*, *Trinema*, *Cyphoderia*, *Arcella*, etc., in what has been supposed to be the condition of conjugation, and have often watched them carefully to learn the results of the process. I have noticed that one individual engaged in the process is often smaller and paler than the other, but frequently also the two were alike in all respects. Between the attached individuals I have observed a fusion of the contents, sometimes a rapid transference of the contents from one to the other test and back again, and at others a sort of circulation or flowing of the contents in a circle from one to the other test. After separation of the tests usually nothing further was observed. In one instance I saw two small Difflugians conjoined with the mouth of a larger, all of the same form; and in another instance I saw three small individuals of *Difflugia spiralis* in the same manner conjoined with one large one of the same species.

I have long sought for the mode of multiplication of the test-covered Rhizopods, but thus far with little success. It appears as if the different forms with which we meet are always mature, and rarely are individuals seen with the ordinary characters which distinguish young from adult animals.

Recently I observed a pair of conjoined individuals of *Euglypha alveolata*, which in their procedure appeared to coincide with the mode of multiplication of *Chlamydophrys stercorea*, as described by Cienkowski. One of the *Euglyphæ* was one-seventh of a millimetre long (0.14 mm. long.; 0.068 mm. in the short diameter), and had four long spines diverging from the fundus of the test. This was replete with the contents, including the usual large nucleus; and it presented no perceptible interval between the mass of sarcode and the interior surface of the test. The sarcode was mingled throughout with particles of food, and also included a large *Navicula*. The food was not collected in balls contained in vacuoles, but was diffused through the sarcode, from the mouth to the fundus of the test, imparting to it a brownish hue. The globular nucleus measured $\frac{1}{25}$th of a millimetre.

Closely adherent to the mouth of the larger or parent *Euglypha* was the smaller or younger one, little more than half the size of the parent (measuring 0.08 mm. long, and 0.06 mm. wide). The young *Euglypha* had the fundus somewhat abruptly narrowed and acute, and had projecting from it the same number of spines as in the parent test. The peculiar structure of the test was apparent,

but appeared less extended or unfolded. The contents filled the test, and consisted of clear, colorless, finely granular protoplasm without any mixture of food and without a nucleus.

Such was the appearance of the conjoined *Euglyphæ*, parent and offspring, at the commencement of the observation, at 6¼ o'clock in the morning.

Closely watching the pair, the young *Euglypha* was noticed slowly to enlarge, and the brownish matter of the parent sarcode gently flowed into and became gradually diffused with the previously clear, colorless sarcode of the child. The fundus of the latter expanded and became obtusely rounded, like that of the parent. The large nucleus of this disappeared, or became so completely obscured as not to be visible. For some time there was no further very perceptible change within either test.

An hour from the commencement of the observation the young *Euglypha* had nearly acquired the size, shape, and appearance of the parent, and it measured 0.112 mm. long, and 0.064 mm. broad. Now commenced an active circulation, a cyclosis, of the contents of the two tests, resulting in a thorough admixture. The sarcode flowed continuously from the parent on one side through the mouths into the child and back again on the other side. Both tests were replete with one continuous mass of brown, granular sarcode, without nucleus or contractile vesicles, but with the *Navicula*, which remained within the parent. During the circulation of the sarcode, two of the spines, with the circular scale at their base, became detached from the young *Euglypha*. The circulation ceased. At 7½ o'clock I first observed the appearance of a contractile vesicle, 0.016 mm. in diameter, at the fundus of both animals. The vesicle collapsed and reappeared in two, three, or four, each again successively collapsing. With the appearance of the contractile vesicles the contiguous sarcode began to clear up, the brownish matter accumulating in advance of the usual position of the nucleus when present.

At this time the young *Euglypha* measured 0.116 mm. long, and 0.064 mm. broad.

The sarcode of the parent now contracted at the middle, leaving a space between it and the test. The same change occurred in the child. The sarcode of the parent next cleared up in the vicinity of the mouth, then separated from that of the offspring, and retracted a short distance within the mouth.

At 5 minutes to 8 o'clock the two *Euglyphæ* bent slightly from side to side, protruded delicate pseudopods, and in two minutes afterwards were completely separated with their mouths directed downward, and their fundi turned towards my eye.

Half an hour after separation, a pale nucleus had made its appearance in both individuals occupying the usual position, and measuring 0.028 mm. in diameter. Two or more contractile vesicles disappeared and reappeared around the position of the

nucleus. While the parent retained the original size, the young *Euglypha* was 0.12 mm. long, by 0.064 mm. broad.

From this observation of the mode of multiplication of *Euglypha*, coupled with that of Cienkowski on the multiplication of *Chlamydophrys*, it may be inferred that all the test-bearing Rhizopods multiply in a similar manner.

The well-fed and replete Rhizopod rapidly protrudes from its test half its sarcode, which assumes the form and constitution of the parent and then separates from it. It is the division of the sarcode mass, as in an *Amœba*, with the development of a new test upon the extruded portion. In forms like *Hyalosphenia*, *Euglypha*, and *Arcella*, the peculiar test is a production from the ectosarc. Without having observed the process, I suspect that the species of *Difflugia* in the act of multiplication protrude their offspring mass of sarcode among particles of sand, which at once adhere and build up the strong wall of their test.

The mode of multiplication of the test-covered Rhizopods reminds one of the mode of production by division of the Desmids, and, in observing the process of production of the *Euglypha*, I was forcibly struck with its resemblance to the mode of production of *Arthrodesmus octocornis*. The production of the young Rhizopod would correspond with the production of a half cell of a Desmid.

The mode of production of Rizopods, as indicated, suggests the probable mode of multiplication of the chambers of the Foraminifera. Masses of sarcode, successively larger and larger, may from time to time be quickly protruded to form the successively larger and larger chambers. The walls of the chambers of the calcareous forms may be developed like the chitinous wall of an *Arcella* upon the protruded mass of sarcode, and the particles of sand of the arenaceous forms may become adherent in the same manner as is suspected to be the case in *Difflugia*.

In this connection it has occurred to me that just as the sarcode mass of a Rhizopod, previous to division, will apparently suddenly grow or expand to nearly double the size, perhaps also in this mode in many tissues of the higher animals we may have a similar procedure in the reproduction of cells. Perhaps in this way the deep cells of the epidermis may give rise to the next series above, or the old ones may be displaced by extension of the protoplasmic mass below.

After observing the birth of a *Euglypha*, I collected material rich in Rhizopods, and spent much time in searching for others in the act of reproduction.

In some water squeezed from sphagnum collected near Swarthmore College, there were abundance of the Difflugian, which I have named *Nebela flabellulum*, with fewer individuals of *Nebela numata*. They were all replete with food, and in most cases the tests so well occupied by the sarcode as to leave no perceptible

interval. Incidentally it may be observed that when a Difflugian discharges all its food or the remains of it and is some time deprived of sustenance, the sarcode mass becomes reduced so as to occupy but a small portion of the space within the test to which it is then attached by long threads of the ectosarc. Having observed an individual of *Nebela numata* with a small bulbous mass of sarcode projecting from the mouth, I watched it closely. In the course of one hour and three-quarters the protruded sarcode had gradually enlarged and assumed the form and nearly the size of the test. Half an hour later the sarcodic mass suddenly burst, leaving detached from the *Nebela* test two large and clear globules of protoplasm, and separately the mass of granular matter, remains of the food, that had occupied the entosarc. Later, the two globules of protoplasm appeared shrivelled, and the *Nebela* test contained only some dirt, part of the remains of the food which had occupied the entosarc.

Later, I saw the same process nearly repeated with a *Nebela flabellulum*. This measured a tenth of a millimetre broad, with a fraction less in length, and when first noticed had a mass of protruding protoplasm about one-thirtieth of a millimetre in diameter. Three hours subsequently the latter had separated from the mouth of the test, and had acquired nearly the size and form of the *Nebela*. In this condition it remained another hour, and shortly afterwards appeared shrivelled and dead. The *Nebela* test appeared to be empty of sarcode and contained only dirt, apparently the remains of the food which had occupied the entosarc.

Hertwig and Lesser (Archiv f. Mikr. Anat. 1874, Pl. III., figs. 8 B. C.) represent the same condition in *Lecythium hyalinum* as the result of dissolution.

Bütschli mentions a nearly similar occurrence with an *Arcella*. He says that after the conjugation of a pair, he observed one of the animals with a large portion of the protoplasm protruded. Later, this lay near the *Arcella* as a clear circular plate of the same size, but without mouth or structure. The protoplasm had withdrawn into the test, and, later, both appeared decomposed.

These last cases may have been abortive attempts at reproduction, ending in dissolution.

During the recent observations to detect the mode of multiplication of Rhizopods, I found an *Arcella vulgaris* which contained between the central sarcodic mass and the test four oval bodies. These, at first glance, I thought were young *Arcellæ*, but discovered that they were eggs, and, watching them for several days, they were seen to develop Rotifers. They were prevented from escaping from the test by the sarcode mass of the *Arcella*, and finally all died together.

On the Velocity of Infinite Fall.—Prof. PLINY E. CHASE remarked that in his studies of the influence of planetary centres

of oscillation, orbital collision, *vis viva*, harmonic nodes, and luminous undulation, his attention had been lately directed to Ennis's views[1] respecting the influence of the velocity of infinite fall. In nebular condensation from r to $\frac{r}{n}$, the increase of radial velocity is $(\sqrt{n}-1)\sqrt{2gr}$; the circular-orbital velocity at $\frac{r}{n}=\sqrt{ngr}$; therefore the increment of radial velocity would be sufficient to produce orbital velocity when $n=\frac{2}{3-\sqrt{8}}=11.656854$.

If M = modulus, or the present light of the sun's homogeneous luminiferous atmosphere, there appears to have been four transformations of uniform into variable velocity, since the nebular rupture of the nearest fixed star, α Centauri. For $\pi^4 M = 214289$, earth's mean distance being taken as the unit. The estimates for the distance of α Centauri, vary between 211400 and 231200. Five rupturing condensations from α Centauri, bring us to earth; and single rupturing falls from Neptune, Uranus, Saturn, and Jupiter, bring us, respectively, to the Asteroids, Mars, Venus, and Mercury. The following table exhibits the accordance between theoretical and observed positions:—

$\pi^4 M \div n^5 = .996$		Earth	= 1.000
Neptune	$\div n = 2.577$	Astræa	= 2.577
Uranus s. p.[2]	$\div n = 1.517$	Mars	= 1.524
Saturn s. p.	$\div n = .749$	Venus a.	= .749
Jupiter s. a.	$\div n = .473$	Mercury s. a.	= .477

Rev. Charles F. Thomas was elected a member.

The following paper was ordered to be published:—

[1] "Origin of the Stars."

[2] s. secular; p. perihelion; a. aphelion.

ADDITIONAL NOTE ON BASSARICYON GABBII.

BY JOEL ASAPH ALLEN.

About a year since, in the Proceedings of the Academy of Natural Sciences of Philadelphia,[1] I described and gave figures of the skull of *Bassaricyon Gabbii*, a new Procyonid, and pointed out its distinctive cranial characteristics. At that time the skin, belonging to the same individual as the skull, had been accidentally mislaid, and could not then be found. Since that time, in re-arranging the collections at the National Museum, it has come to light, and has been kindly forwarded to me for description by Professor Spencer F. Baird. As stated in the original description of the species, the only specimens thus far known to naturalists consists of the skin and skull of a single individual collected in Costa Rica by Mr. William M. Gabb, during his recent survey of that Republic. The skull indicated a form widely distinct, generically, from any other known Procyonid, presenting several features of resemblance to *Bassaris*. In external form, however, it proves to be much like *Nasua*, though very much smaller, and with a quite different pattern of coloration. The skin has been finely mounted by Professor Ward, of Rochester, N. Y., and offers the following characters (Plate 2):—

Nose produced, as long or longer than in *Nasua*, and of similar form; ears rather small, rounded, about an inch in length, and about as broad as long; claws large and strong, moderately curved and pointed, gradually tapering to the end, those of the fore-feet nearly an inch in length—much longer and less curved than those of the hind-feet; tail long, the vertebræ alone fully one-half the length of the head and body. General color of the body brownish-black, with the tips of the hairs rusty-yellow, especially over the thoracic portion of the dorsal surface. Nose and chin grayish-white, this color extending back in a narrow streak along each side of the nose to behind the eye, the streaks being separated by a narrow band of black; the gray of the chin also extends posteriorly on either side to beyond the angle of the mouth; a small whitish spot below the eye and another on the

[1] Description of a new generic type (*Bassaricyon*) of *Procyonidæ*, from Costa Rica. Proc. Acad. Nat. Sci. Phila., 1876, pp. 20–23, pl. I.

cheek; also an indistinctly defined area of whitish on the sides of the neck, immediately in front of the shoulder; throat and breast pale yellowish-brown, varying to grayish-brown, much lighter than the general coloration. Ears within and on the edges yellowish-white; externally brownish-black. Tail basally concolor with the back, passing into black at the tip, wholly without lighter rings, or even traces of them; hence the coloration of the tail is entirely different from that met with in *Nasua* and *Procyon*. The pelage is rather full and soft, and brownish beneath the surface. The long hairs are, many of them, faintly tipped with pale rusty; these rusty tips are most numerous over the anterior half of the back, where they are also longer and of a lighter or more golden tint. The ventral surface of the body is scarcely lighter than the back. Size nearly that of *Mustela Pennanti*. Length from the tip of the nose to the eye, 3.07 (inches); to ear, 5.00; to occiput, 5.60; to base of tail, 21.00; tail vertebræ, 11.25; tail to end of hairs, 12.75; fore-foot, 3.00; hind-foot, 3.85.

In general form, especially in the long slender nose, and somewhat in the *pictura* of the face, this species bears considerable resemblance to *Nasua*, much more resembling the species of this genus than those of *Procyon*. The claws, however, are much longer and more attenuated, and the general form of the body is slenderer and the tail longer. In dentition and cranial characters, however, this species differs widely in nearly every detail from any other known form of the family.

The specimen here described and figured is a fully adult (in fact, quite aged, as shown by the skull and dentition) female. Talamanca, Costa Rica (*Gabb*).

JULY 3.

The President, Dr. RUSCHENBERGER, in the chair.

Fifteen members present.

Protovermiculite, a New Mineral Species.—Professor GEO. A. KÖNIG described a micaceous mineral from Magnet Cove, Ark., to which he gave the name Protovermiculite, in preference to that of Hydrophilite, a name already existing in the list of mineralogic synonyms. The mineral occurs in large foliated plates, loose in the soil, and also in smaller prismatic crystals, with Appatite in the black garnet, of the same locality. The structure is strongly micaceous, the habitus hexagonal; but optically biaxial, and hence, as all biaxial micas, probably *monosymetric*. The angle of the optical axis is very small, the hyperbolas touching each other. Thin laminæ are slightly flexible, though without elasticity. Cleavage is less marked than in micas generally. The color is grayish-green in the interior of the plates, yellowish-silvery to bronze color on the outside. Thin laminæ transmit brownish-green light. Hardness a little below 2. Lustre submetallic, and touch somewhat unctuous. Spec. gr. = 2.269. Before the blow-pipe it exfoliates slightly, and fuses at 4 to a black glass. Yields much water in the closed tube. No characteristic reactions with the fluxes. Strong sulphuric acid attacks the powdered mineral vehemently, causing complete decomposition, while flocculent silica separates; hydrochloric acid also effects decomposition. The finely pulverized mineral, placed in an air-tight space over oil of vitriol, loses 20.3 per cent. of water in 24 hours, when the weight remains constant; the water is reabsorbed in less than one hour in contact with the atmosphere. A larger quantity of water is not absorbed, even when placed in a saturated atmosphere. There seems to be a ground for this behavior, although hidden at present. Why are other micaceous minerals, much more cleavable than the vermiculites, and furnished with more capillary spaces, not at all hygroscopic? It may be supposed that a force of attraction other than a mere physical or rather mechanical one must exist in the latter. However, the author is in accord with Prof. J. P. Cooke, Jr.'s, views regarding the cause of exfoliation in vermiculite minerals and crystals of artificial compounds. (*Am. Acad., Boston*, 1874.) Prof. Cooke attributes exfoliation to the escape of the water of crystallization causing the structure of a mineral to break up. Some substances loose their water of crystallization without forcible means, over sulphuric acid, for instance, and their structure is not broken up; yet they do not reabsorb the lost water. Sodium carbonate and the sulphates $RSO_4 + 12$ aq

may be cited in this connection. Evidently there is here a broad field for study of the underlying laws. Still Prof. Cooke's hypothesis is accepted for the present, as far as it regards the vermiculites. The present case of Protovermiculite gives it support. Here are two micas, presenting, as will be shown further on, an identical composition, qualitatively and quantitatively, having nearly equal quantities of water. Exposed to strong heat the one increases its volume tenfold by exfoliation, the other hardly doubles it. But when it is found that the former retains over oil of vitriol 11 per cent. of water, whilst the latter only retains 3.36 per cent. under the same conditions, their differing behavior may be accounted for to a certain extent, on the assumption that this water is essential to the structure; the remaining water being accidental moisture.

Composition of the Protovermiculite was found to be in several analyses (the greenish part differs from the silver-white or bronze only by a few tenths of per cent. of ferrous oxide):—

		Oxygen.			Atomic quotients.	
SiO_2	= 33.28	17.738	Si	= 15.55	0.555	
Al_2O_3	= 14 88	6.934	Al	= 7.95	0.145	0.184
Fe_2O_3	= 6.36	1.908	Fe	= 4.45	0.039	
FeO	= 0.57	0.125	Fe	= 0.45		
MgO	= 21.52	8.510	Mg	= 13.01	6.550	
H_2O (of crystall.)	= 3.36				0.181	
H_2O (hygroscop.)	= 20.54					
MnO	= trace.					
TiO_2	= trace.					
	100.51					

Dividing with 0.184 (Al + Fe) into the other atomic quotients, the ratio is obtained:—

$$Si : Al : Mg : O : H_2O = 3.01 : 1.00 : 2.989 : 11.918 : 0.983$$

corresponding absolutely with the symbol—

$$\overset{I}{R_3}\,\overset{VI}{R}\,\overset{IV}{Si_3}\,\overset{I}{O_{12}} + H_2O.$$

The mica from Culsagee, North Carolina, described by Prof. Cooke (*loco cit.*), as *Culsageeite*, is composed as follows, according to closely agreeing analyses by himself, Dr. Thos. M. Chatard and the author (F. A. Genth, Corundum, *Proc. Am. Philos. Soc. of Philadelphia*, 1873), and after deducting the water lost over sulphuric acid:—

	Culsageeite (Cooke).	Protovermiculite (König) after treatment over SO_4H_2.
SiO_2	= 37.58	41.62
Al_2O_3	= 19.73	18.60
F_2O_3	= 5.95	7.25
FeO	= 0.58	0.71
MgO	= 25.13	26.90
H_2O	= 11.09	4.20

The ratio of Culsageeite corresponds closely to the symbol—

$$R_3 \mathfrak{R} Si_3 O_{12} + 3H_2O.$$

It might seem that a difference of two molecules of water were not sufficient basis for a separation into two species. Yet when the important rôle which this water plays in the process of exfoliation is considered, and that Culsageeite exfoliates about ten times stronger than Protovermiculite, with an otherwise identical composition, the author is of opinion that strict science requires a separation. The name was chosen to indicate the imperfect vermiculation as compared with the other members of this group.

On the atomic ratio of Jefferisite, this most characteristic vermiculating mineral, there existed some uncertainty in the mind of the author, since the analyses made by Prof. Brush, Dr. Chatard, and himself do not quite agree, and yield atomic quotients quite unsatisfactory. In connection with the above investigation it was thought important to analyze the West Chester mineral once more, with the greatest care possible. 0.5 gr. of the finely pulverized mineral was placed in an air-tight bell-jar over sulphuric acid. In two days it lost 0.054 gr. or 10.8 per cent. It was kept for eight days longer, and weighed every second day, the weight remained absolutely constant. The same substance was then allowed to reabsorb the hygroscopic water by exposure to the air, and afterwards placed in an air-bath at a temperature of 106 C° for 18 hours, when it only lost 8.6 per cent.

The air-dry substance gave—

SiO_2	= 33.03	Si	= 0.555		
Al_2O_3	= 17.38	Al	= 0.1690	0.2153	
Fe_2O_3	= 7.41	Fe	= 0.0463		
FeO	= 1.44	Fe	= 0.0210	0.5252	
MgO	= 20.16	Mg	= 0.5042		
H_2O	= 20.90	H_2O	= 0.561 (dried over SO_4H_2)		
	100.59	H_2O	= 0.683 (dried at 106 C.°)		

Dividing by 0.2153 (Al + Fe) we obtain—

$$Si : \mathfrak{R} : R : H_2O = 2.58 : 1.00 : 2.44 : 2.91 : (3.17)$$
$$= 5.16 : 2.00 : 4.88 : 5.82 : (6.34).$$

(1) Brush's analysis (*Am. Journ. Sci.*, 1861); (2) Dr. Thos. M. Chatard's analysis (*Genth on Corundum l. c. supra*); and (3) the author's (*ibidem*) give the following ratios:—

	Si : $\mathfrak{R}$: R
Brush	5.228 : 2 : 4.416
Chatard	5.412 : 2 : 4.928
Kŏnig, 1st	5.054 : 2 : 4.736
" 2d	5.16 : 2 : 4.88

Prof. J. P. Cooke deduced from the first ratio the formula $R_4 \mathfrak{R}_2 Si_5 O_{20}$, omitting the nearly half atom of R in excess of 4. This makes the mineral a true orthosilicate, and is quite satisfactory. But does the analytical result justify such a course? Only on the

supposition that the analyzed material was heterogeneous. On the other hand, the two analyses by the author, made five years apart, and on quite different material, agreeing so well among themselves, point very strongly to the fact that instead of omitting the half atom, it has to be increased to a whole atom, and the formula of Jefferisite is therefore to be written—

$$R_8 R_2 Si_5 O_{21} + 6H_2O \text{ (König)},$$

instead of—

$$R_4 R_3 Si_5 O_{20} + 6H_2O \text{ (Cooke)}.$$

By doubling the molecules of Culsageeite and Protovermiculite their close affinity to Jefferisite is still more perceptible:—

Jefferisite	$R_8 R_2 Si_5 O_{21} + 6H_2O$
Culsageeite	$R_6 R_2 Si_6 O_{24} + 6H_2O$
Protovermiculite	$R_6 R_2 Si_6 O_{24} + 2H_2O$.

Jefferisite and Culsageeite exfoliate with equal energy; the author is inclined to write the formulas of the three species in the above manner as a consequence, on mechanical principles.

JULY 10.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

The death of David S. Brown was announced.

JULY 17.

The President, Dr. RUSCHENBERGER, in the chair.

Thirteen members present.

The resignation of Dr. Henry H. Smith, as a member, was read and accepted.

JULY 24.

The President, Dr. RUSCHENBERGER, in the chair.

Nine members present.

Note on Color Variation in Mammals.—Mr. J. A. RYDER called attention to the fact that many animals, when long domesticated, as the horse, ox, dog, and cat, were frequently asymmetrically colored. Horses were often seen with one white foot, or in extreme cases with three, while the white color sometimes extended further up the limb upon one side than upon the other. He had

frequently noticed the same sort of irregularity in the coloration of cattle. It was also noticeable in a very marked degree in rabbits and guinea-pigs, and he had recently seen some goats that were exceedingly asymmetrical in the disposition of color areas.

In studying color variation among feral animals he had noticed that such variations, so far as his observations had extended, were invariably symmetrical. In the case of a raccoon, in the collection of the Zoological Society of Philadelphia, where the variation from the typical coloration of the species was great, the color areas were disposed symmetrically in the same manner as in the ordinary specimens that were its companions in the same cage. The difference was only in the shade, this specimen being a rich brownish-yellow, except the annuli around the tail and the lateral bands on the face, which were of a considerably deeper hue. The nose, feet, and eyes in the ordinary specimens are black; in this specimen all the dermal structures had assumed a much lighter tint, nearly a flesh color. The iris has assumed a remarkably different tint from the jet black of the others, and it is a good illustration of the correlation in coloration of the pelt and eyes, without at the same time having reached total albinism. In a specimen of *Lepus sylvaticus* in the Academy's collection, said to be from New Jersey, the fur is cream colored, and very long and soft, but perfectly symmetrical and uniform in color, and in a specimen marked *L. audubonii*, from California, there is a symmetrically disposed median white band running from the parietal region to the muzzle. In rats, nearly white, the color areas were also found to be very nearly the same on both sides, and in two specimens of *Arvicola*, one with a white head was found to be colored symmetrically, and the other with white head and shoulders and white patches on the flanks and outer sides of thighs was also colored symmetrically. In specimens of Virginia deer in the collection of the Academy, where white and the usual color were separate, the same symmetry was noted as in the other feral specimens mentioned above.

In many domestic animals there is a most decided tendency to preserve, more or less, the symmetry of coloration of the ancestral type, but domestication seems to be at the bottom of the great variability and asymmetry of color of animals brought under its influence. The camel, however, seems to be an exception.

The following summary of the foregoing facts was offered:—

1. That bilateral symmetry of coloration is interfered with in some way by domestication.

2. That where variation in color takes place in feral animals, they are invariably, so far as observed, symmetrically colored.

3. That it is possible that the degree of asymmetry is an indication of the length of time that domestication has been operative.

JULY 31.

The President, Dr. RUSCHENBERGER, in the chair.

Seventeen members present.

Poisonous Properties of the Leguminosæ. — Dr. ROTHROCK remarked that hitherto we had by common consent regarded the plants of the order Leguminosæ as, on the whole, rather innocuous. During the past few years a number of its representatives have been attracting attention on account of their supposed agency in poisoning cattle and horses in our southwestern territories. It is true that none of these save the *Sophora*, to be mentioned last, have been subjected to a severe scientific test by physiological experiments; still the main facts alleged are doubtless to be depended upon.

The veteran botanist of the Pacific Coast, Dr. A. Kellogg, has a short article on the subject in the *Proceedings of the California Academy*, vol. vi. p. 3, which goes over most of the ground. It is then only to give an increased circulation to the facts that he alluded to them here.

In southern Colorado, especially about Fort Garland, the offending plant is *Oxytropis Lamberti*, a most variable species. At first, from some of the symptoms, it was supposed that it was due to something like *Aconitum*, but as the region was out of the range of any considerable quantity of *A. nasutum*, the only species likely to be found near, and as we had no definite observations on its action, attention was directed elsewhere, and the *Oxytropis* pretty clearly fixed as the plant. The effect of this appears to be long enduring; the animal becoming demented, and wasting away as his fondness for the poison increases to something like the opium habit in man. Dr. Kellogg contrasts this with the temporary effects (intoxication and stupefaction) of a southern species of *Tephrosia*. During Dr. Rothrock's stay at New Camp Grant, in Arizona, in 1874, it was alleged that *Hosackia Purshiana* was producing like effects on the horses.

In California Dr. Kellogg regards the noxious plant there as *Astragalus Menziesii*, Gray. And it is also asserted that *Astragalus Hornii*, Gray, and *Astragalus lentiginosus*, Dougl., are in the same list in California.

The general name for the disease in the animals is "Loco." Among the inhabitants of the southwest it simply refers to their becoming foolish. As yet we cannot say on what active principle the effects depend; neither do we know whether it is dissipated in drying. It would be well if exact experiments in this direction could be instituted. The boundary lines between a poison and a remedy are rather those of degree than of kind, and it is

not improbable that in these very plants our physicians may find a means of "counteracting some tendency to death."

Regarding *Sophora speciosa*, Benth., from Texas, our knowledge is now well grounded, thanks to Prof. H. C. Wood, Jr., M.D. He has succeeded in obtaining an alkaloid, which he names *Sophoria* from the bean. Its effects are not unlike those of Calabar bean. For a full account of this see *Philadelphia Medical Times*, August 4, 1877. The Indians of Texas use the bean to produce an intoxication which lasts from two to three days. Half a bean, it is said, will induce intoxication, and a whole one may lead to dangerous symptoms.

Julia A. H. Walker was elected a member.

AUGUST 7.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

AUGUST 14.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

A paper entitled "On Lagochila, a new genus of Catostomoid Fishes," by David S. Jordan and A. W. Brayton, was presented for publication.

The deaths of Dwight D. Willard and Timothy A. Conrad were announced.

Influence of Magnetism on Living Organisms.—A letter from Dr. JOHN VANSANT, dated New Orleans, December 14, 1876, was read, stating substantially that he had killed a spider by exposing it to the influence of a magnetic current.

The animal had its vitality destroyed by the magnetism emanating from a small steel magnet of the U shape, commonly sold in the shops. The legs of the magnet were about two and a half inches long by a half inch wide, and one-sixth of an inch thick, the distance between the poles being about one quarter of an inch.

He noticed a small spider actively running along the arm of his chair. He brushed it off carefully with his finger and it fell upon the carpet. It began to run but was somewhat impeded by the roughness of the carpet. Having removed the armature he slid the magnet along the carpet following after the spider until it was between the poles. The animal almost instantly stopped and in a

few seconds seemed to be motionless; but at the end of two or three minutes it began slowly to move its legs and elevate and depress its head, thus touching and separating itself from one or the other of the poles, but without going from between them. He did not touch it. At the end of five minutes the spider was quite still. After a lapse of ten minutes he covered both spider and magnet with a large tumbler. At the expiration of two hours he removed the glass and observed the spider with a magnifying lens. It was apparently dead. It was not touched during this inspection. It was left in position some twelve hours longer.

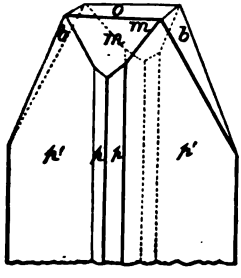
Dr. Vansant states that he has killed spiders and other small animals, as worms and insects, as well as some plants, by magnetism at different times during the past eight years, but never before succeeded in destroying the life of a spider so quickly and without touching it frequently, though lightly, with the magnet he used. In the opinion of Dr. Vansant this experiment demonstrates that *magnetism affects the functions of living beings.*

Mineralogical Notes.—Professor GEO. AUG. KÖNIG presented the result of an examination of silver ore from "Silver Islet," Lake Superior. In a gangue of Calcite and some quartz one observes Galenite, Sphalerite, native silver, and spots of a pinchbeck colored mineral, possessing metallic lustre were observed. A picking by hand of the latter was not possible, owing to the smallness of the grains. By placing the material in dilute hydrochloric acid, the metallic minerals were left as a spongy mass, including the quartz grains; Sphalerite could be eliminated by sorting. The mixture was then analyzed with the following result:—

Ag	=	32.68
Pb S	=	38.18
(Ni, Co)	=	8.96
Fe.	=	0.35
S	=	1.81
As	=	10.56
Sb	=	trace.
Quartz	=	6.00
Calcite	=	1.20
		99.74

The mineral mixture was completely decomposed by nitric acid. Nickel and arsenic are in the ratio = 2.15 : 1 equal to "Niccolite." The latter mineral is strongly cobaltiferous. The sulphur must be considered to be combined with silver as Argentite. When particles of the mixture, showing no Niccolite under the lens, after having been flattened out and rubbed in the mortar, were then dissolved in nitric acid, silver removed by hydrochloric acid, the filtrate gave invariably the arsenic reaction. It is highly probable that a very basic silver arsenid is present in the ore. The speaker, not being aware of any identification of Niccolite from Silver Islet, deemed it expedient to make this communication.

On Strengite from Rockbridge Co., Va.—Prof. GEO. AUGUSTUS KÖNIG described a mineral which he discovered in cavities in Dufrenite. The surface of these cavities is coated with a green spheroidal and radially laminated substance, greenish-yellow, and somewhat silky on the fracture, which the speaker considered to be Cacoxenite. On this latter substance clusters of beautiful, though small, crystals are seen. They present short prismatic forms; their color varies from light pink to deep carmine red, even towards amethystine shades; their lustre is vivid and vitreous, and their hardness slightly below 4. They are transparent. A magnifying power of 2 diameters is required for a proper analysis of the symmetry of the crystals, when they disclose the shape shown in the figure. The prisms are invariably terminated by a rectangular face (often perfectly square) which possesses adamantine lustre (*o*), and by two domes (*b*, *b*) (*m*, *m*). The *m* faces are smooth and brilliant, the *b* faces are striated. There are two prisms, and the prismatic faces (*p'*) appear striated, but not so strongly as the *b* faces. Pyramidal faces appear on some of the crystals, but only on one side, whilst opposite only the domatic face *m* is visible. The face *o* in this case presents a pentagonal shape. None of the crystals possessing this curious hemimorphism was of measurable size. The goniometer used is one with two telescopes, but the light was so feebly reflected from the minute faces that no image could be obtained with the eye-piece, which, therefore, was removed, and the light reflected into the eye directly.



A number of observations were made for every angle and the mean taken, but this method was necessarily uncertain and ineffective.

Angles measured.

$p \wedge p$	=	122° 20′
$p' \wedge p'$	=	117° 25′
$m \wedge p$	=	139° 35′
$o \wedge p'$	=	90° 20′ (first crystal.)
$o \wedge p$	=	90° 5′ (second crystal.)
$b \wedge b$	=	51°
$m \wedge m$	=	64°
$b \wedge o$	=	115° 20′
$m \wedge o$	=	122°

The symmetry of the mineral is plainly orthorhombic, although the angle $o \wedge p$ was not found exactly 90° by direct measurement; because the prismatic face is not even, but striated. The macrodomatic angle $m \wedge m = 64°$ and $o \wedge m = 122°$, we deduce—

$$(180° - 122°) = 58°, \frac{m \wedge m}{2} = 32°$$

$$58° + 32° = 90°.$$

T is, the basal plane *o* is exactly at right angles with the main s.

A ground form and its parameters could not be established as pyramidal faces were observed on any of the measurable tals.

or the projection of the crystal one has—

Macrodome	tg. 58° = 1.603
Brachydome	tg. 64° 40′ = 2.112
Prism p′	tg. 61° 10′ = 1.816
Prism p	tg. 58° 42′ = 1.644

Blowpipe Characters.—In the closed tube the color of the mineral turns to golden yellow, has a tendency to decripitate, and lds water. Treated [illegible] s with the oxydizing flame, mineral is [illegible] t the change of color, while flame colo [illegible] oric acid). In the point of the reducing [illegible] t 4 to a black non-magnetic glass. With [illegible] iron reaction.

For analysis o[illegible] e collected. After ignition the reddish-brow[illegible] in strong nitric acid. Phosphoric acid was [illegible] ybdic solution, and in the filtrate the ferri[illegible] hydrate. The author obtained water = 6.1 mg[illegible] 19.8 mgr. (P_2O_5 = 12 mgr.), Fe_2O = 13.0 mgr., or ...

H_2O	1.104	= 4.16
P_2O_5	0.277	= 1.045
Fe_2O_3 = 42.3	: 100 = 0.265	= 1.000

101.47

The mineral is, therefore, $Fe_2P_3O_8 + 4H_2O$, and is identical with "Strengite," described by A. Niess (Neues Jahrbüch f. Min. 1877, p. 8). According to Niess, Strengite occurs at the Dunsberg Limonite mine, near Giessen in mamillary, botryoidal aggregations with radially fibrous structure and drusy surfaces, rarely in single crystals, possessing strong vitreous lustre, transparency, and red color in all shades, especially peach blossom and carmine tints, sometimes nearly colorless. The crystals present a tabular form which is produced by the predominance of the macropinakoid. Niess has only observed the prism, the pyramid, and the macropinakoid, with indications of a macrodome. Hence the type of Strengite from the only localities now known—Giessen, Hessen, and Rockbridge Co., Va.—is remarkably differing. The basal plane and the domes, so characteristic at the latter place, are quite wanting at the former. But of the identity of the mineral there is hardly any doubt possible. The Rockbridge variety is only observed in crystals.

Since presenting the first description to the Academy the speaker examined a specimen on which there was one crystal corresponding to the Skorodite type of the Giessen variety.

AUGUST 21.

The President, Dr. RUSCHENBERGER, in the chair.

Eighteen members present.

The Lacquer Tree.—Professor THOMAS MEEHAN remarked that he had had an extract from the *Public Ledger* sent to him, as State Botanist, with the request that he would give any information in his power as to the chances of the tree thriving in this State. He said:—

"The Lacquer plant, *Rhus vernicifera*, is so much like our common poison ash, *R. venenata*, and Japan trees generally do so very well in this latitude, that there is no room to doubt that the tree would thrive. But it is not worth while to introduce the plant, as our own poison ash has the same properties in every respect. The 'Lacquer' is the juice of the tree. It is at first whitish, but becomes black when exposed to the air. It is mixed with a small portion of oil derived from a kind of Trumpet vine, and the exact portion of oil, or the way of mixing it, is supposed to be a secret possessed only by those 'in the trade' in Japan. The 'Lacquer work' itself is made simply by putting very fine powdered charcoal on the wood before applying the prepared resin. Crude gum which I have seen from this Japan poison ash is so exactly like that which I have taken from our own poison ash, that I have little hesitation in saying that any one wishing to try the experiment, would do just as well with the product of our own swamps as with imported trees from Japan.

"It is well, however, to remember that both of these—our own and the Japan trees—are excessively poisonous, much more so than our common poison vine. It is very friendly with me, as almost all these noxious plants are; but I have known many persons very badly served even by passing where the trees were."

AUGUST 28.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

B. F. Lautenbach, M.D., and Frank Woodbury, M.D., were elected members.

Prof. Wm. A. Buckhout, of Centre Co., Pa., was elected a correspondent.

The following paper was ordered to be printed:—

ON LAGOCHILA, A NEW GENUS OF CATOSTOMOID FISHES.

BY DAVID S. JORDAN AND A. W. BRAYTON.

During a recent collecting tour in the Southern States the writers secured in the Chickamauga River, near Ringgold, Catoosa County, Georgia, a species of Sucker, new to science, which is believed to represent a new generic type. This genus, for which we suggest the name *Lagochila* (*lagocheilos*, having a hare-lip, in allusion to the peculiar mouth, and to the vernacular name of Hare-lip Sucker), bears somewhat the same relation to *Myxostoma*, and the other typical *Catostominæ*, that the genus *Exoglossum* bears to the typical *Leuciscinæ*.

Lagochila lacera, Jordan and Brayton, gen. and sp. nov.

Generic Characters.—Similar to *Myxostoma* (*Ptychostomus*, Agassiz) except in the structure of the mouth parts. Dorsal fin short; lateral line well developed; scales large, subequal; air-bladder in three parts; fontanelle between parietal bones well developed, pharyngeal bones weak, with numerous small teeth; upper lip not all protractile, greatly enlarged, finely plicate; lower lip longitudinally enlarged, but attenuated, and singular in form. It consists of two elongated and narrow lobes, separated by a narrow deep fissure, which extends inward to the edge of the mandible proper, which seems to be armed with a rather hard or almost horny plate, about as in the genus *Pantosteus*. The two lobes of the lip are weakly papillose. The lower lip is entirely separated from the upper at the angles by a deep fissure. Over this fissure the skin of the cheeks lies as a sort of cloak; the crease separating this skin from the mouth, extending up on the sides of the muzzle. The fissure between the lips extends down on the skin of the under side of the head. The opercle is extremely short, and the eye is entirely in the posterior part of the head.

Fig. 1.

1

2

1. View from below. 2. Front view of mouth (natural size).

Specific Characters.—Head rather short—4⅔ in length, conical, with lengthened snout, the region between the eyes flattened and

provided with prominent mucous ridges; cheeks and lower part of the head rather swollen; greatest length of opercle not more than that of eye. Eye medium, contained twice in snout, $4\frac{1}{3}$ in length of side of head.

Body rather elongate, not much elevated or compressed, the form being intermediate between that of *Myxostoma cervina* and that of *M. duquesnii*. Position and form of fins as usual in the genus *Myxostoma*, the dorsal rather short and not especially elevated, its free border rather more concave than usual.

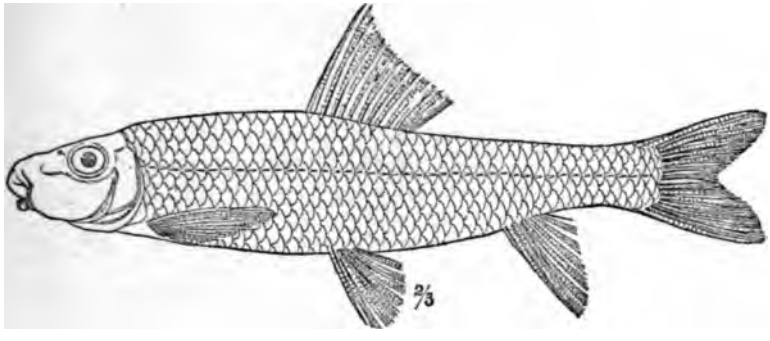
Fin rays: D. I. 12, A. I. 7, V. 9. Scales rather large, but little crowded forwards, 5–45–5. Lateral line very distinct, nearly straight.

Color somewhat olivaceous above, sides and belly more silvery; lower fins faintly orange.

Length of types respectively 10 and 4 and 3 inches.

Hab. Streams tributary to the southern bend of Tennessee River, in the States of Georgia, Tennessee, and Alabama. Fishermen tell us that this is the commonest and most valued species of sucker found in that region, and that it is everywhere known by the name of "Hare-lip Sucker," and sometimes of "Split-

Fig. 2.



mouth" or "Split-lip Sucker." It frequents rather deep waters, and is often taken with the hook. We obtained but two specimens in the Chickamauga, and one in Elk River at Estill Springs, in Tennessee. A minute examination of the bones of the head and jaws is desirable, but we have thought it best to defer it

until more specimens are obtained, not wishing to mutilate the original types.

The drawings accompanying this paper were made from the larger of the type specimens.

The genera of *Catostomidæ* may be thus compared:—

* Body oblong or elongate, with a short, subquadrate dorsal fin of 10 to 17 developed rays.

† Mouth singular; the upper lip not protractile, greatly enlarged; the lower lip developed as two separate lobes; the lower jaw provided with a sheath (*Lagochilinæ*).

a. Air bladder in three parts; scales large, subequal; pharyngeal bones and teeth ordinary; fontanelle well-developed; lateral line present. LAGOCHILA, 1.

†† Mouth normal, the lower lip undivided, either tuberculate or plicate (*Catostominæ*).

b. Air bladder in three parts; lateral line present; fontanelle present; scales large, subequal.

c. Pharyngeal bones very broad and strong; the lower 7 to 10 teeth on each side, greatly enlarged and truncate; the teeth on the upper part of the bone small, as usual in the family. PLACOPHARYNX, 2.

cc. Pharyngeal bones not especially enlarged; the teeth of the usual type. MYXOSTOMA, 3.

bb. Air bladder in two parts.

d. No lateral line; fontanelle present; lips plicate; no mandibulary sheath; scales large. ERIMYZON, 4.

dd. Lateral line well developed; lips tuberculate.

e. Fontanelle distinct; no mandibulary sheath.

f. Scales moderate, not crowded forwards, about equal over the body; body long and little compressed; head long and flattened, transversely concave between orbits; the physiognomy being therefore peculiar. HYPENTELIUM, 5.

ff. Scales small; smaller anteriorly and much crowded; head transversely convex between orbits. CATOSTOMUS, 6.

ee. Fontanelle obliterated by the union of the parietal bones; mandible with a cartilaginous sheath; scales small. PANTOSTEUS, 7.

* Body much elongated, subcylindrical forwards; dorsal elongate, falciform, of 30 or more rays; fontanelle obliterated by the union of the parietal bones (*Cycleptinæ*).

g. Mouth small, subinferior, with papillose lips; scales rather small. CYCLEPTUS, 8.

*** Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present (*Bubalichthyinæ*).

h. Dorsal rays about 30 in number (24 to 33); anal rays about ten (9 to 12); scales large.

i. Pharyngeal bones narrow, with the teeth relatively thin and weak.

j. Mouth small, inferior, protractile downwards; dorsal fin often greatly elevated.

CARPIODES, 9.

jj. Mouth larger, subterminal, protractile forwards (species of larger size, dusky colors, with lower dorsal). ICHTHYOBUS, 10.

ii. Pharyngeal bones strong; the teeth comparatively coarse and large, increasing in size downwards; dorsal fin moderately elevated; mouth inferior.

BUBALICHTHYS, 11.

hh. Dorsal fin with about 50 rays; anal 13; scales moderate; teeth as in *Bubalichthys* (?) (Asiatic species). MYXOCYPRINUS, 12.

SEPTEMBER 4.

The President, Dr. RUSCHENBERGER, in the chair.

Fifteen members present.

On the Bed-bug and its Allies.—Prof. LEIDY remarked that it was commonly supposed that the swallow, pigeon, and bat were infested with the bed-bug, and that those animals introduced the insect into houses. Packard (Guide to Study of Insects, 551) observes that the bed-bug "lives as a parasite on the domestic birds;" and adds that a gentleman informed him "that he has found a nest of swallows on a court-house in Iôwa swarming with bed-bugs." Westwood (Introd. ii. 475, note,) says it is certain that bed-bugs "swarm in the American timber employed in the construction of new houses." "In the western part of our country," continued Prof. L., "I frequently heard that bed-bugs were to be found at any time beneath the bark of the cottonwood and the pine. In these positions I never found one, nor have I ever found the insect except in the too familiar proximity of man. Recently, when in the West, while watching some cliff swallows passing in and out of their retort-shaped mud nests, built under the eaves of a house, I was told that these nests swarmed with bed-bugs, and that usually people would not allow the birds to build in such places, because they introduced bed-bugs into the houses. Having collected a number of the bugs, as well as others from the interior of the house, specimens of both of which are submitted to the examination of the members, I found that while the latter are true bed-bugs, *Cimex lectularius*, the former are of a different species, the *C. hirundinis*. The bugs infesting the bat and pigeon have likewise been recognized as a peculiar species, with the name of *C. pipistrelli*, and *C. columbarius*." Prof. L. further noticed that the habit of the *C. hirundinis* was similar to that of *C. lectularius* in the circumstance that the bugs during the daytime would secrete themselves in crevices of the boards away from the nests. After sunset he had observed the bugs leave their hiding-places and make their way to the nests. From these observations it would appear as if the peculiar bugs of the animals mentioned did not reciprocally infest their hosts.

On the Growth of Cocculus Indicus.—Mr. RYDER remarked that the termini of the branches of *Cocculus indicus*, as observed in the Horticultural Hall in Fairmount Park, were coiled to the left about objects that came within reach. These terminal coils, which simulated tendrils in form, would, if straightened out, measure 6 to 8 inches in length. The buds upon them appeared to be aborted or rudimentary, and as soon as the coil was securely

wound round its object of support, growth in a longitudinal direction in the branch in question seemed to cease; but below the proximal part of the coil, or that nearest the root, one of the fully developed buds would break and continue the ascending axis, which, when it had attained a length of 1 or 2 feet, would coil its terminus, and stop growing lengthwise as the branch had done from which it grew. This process seemed to be repeated indefinitely. The plant might be called a terminal twiner. Other menispermaceous plants seemed to have a similar tendency, though not so marked, and some were not very different in habit from ordinary twiners, as, for example, *Menispermum canadensis.*

SEPTEMBER 11.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

A paper entitled "On a New Species of Helix from Texas," by Wm. G. Mazyck, was presented for publication.

SEPTEMBER 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

The death of H. E. Van Rijgersma, a Correspondent of the Academy, was announced.

On the Distribution of Plants.—ISAAC C. MARTINDALE exhibited specimens of *Phallus*, and stated that he had noticed its reappearance in the yard attached to his dwelling for four years. Its development was very rapid; at the time it was first noticed this year it presented the appearance of a hen's egg with about one-third of the surface protruding from the ground; within twenty-four hours it had more than doubled in size, and showed some signs of an opening at the upper end; about six hours later the stipe had forced its way out to the extent of nearly six inches. Although so offensive in odor, it attracted large numbers of flies, from twenty to thirty being on it at one time. He stated, as a singular fact, that this species reappeared year after year in a space not more than three feet in diameter; and although plants of this class produce an immense amount of spores, not more than four specimens of this species had been noticed near the locality on any occasion.

In connection with the subject, Mr. Martindale further stated that probably no class of plants have a greater amount of pollen

in proportion to the number of seeds produced than the Pines. He had recently detected one tree of *Pinus mitis*, near Camden, which species he believed was gradually disappearing from this section of the country; there were but three cones on the tree, which was a large one, and evidently on the decline.

AUBREY H. SMITH spoke of the disappearance of the Red Oak, *Quercus rubra*, from a locality in western Pennsylvania, about one hundred miles from Lake Erie, that had been visited by him during the past summer. He was informed that it had been quite abundant there thirty or forty years ago; indeed large numbers of fallen and partly decayed trees were still to be seen through the woods.

Mr. MARTINDALE also stated that while a number of plants that were now common in the Southern States bordering on the Atlantic coast, and of frequent occurrence in this latitude and further north a few years ago, were gradually disappearing from their northern localities, other species, heretofore regarded exclusively as southern, were extending their range to the northward. He had recently collected *Pluchea bifrons* near Cape May, New Jersey, a species which had not heretofore been detected in that State.

SEPTEMBER 25.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The death of John Milton Earle, a Correspondent of the Academy, was announced.

A. J. Drexel, Alexis T. Cope, Miss Clementine Cope, and Miss C. E. Cope were elected members.

The following were elected Correspondents:—

Clarence King, of Washington, Daniel C. Eaton, of New Haven, Count A. G. Marschall, of Vienna, Edward Von Mojsisovics, of Vienna, Dionys Stur, of Vienna, Franz Toula, of Vienna, A. Bastian, of Vienna, J. G. Rein, of Frankfurt on the Main, C. Arendts, of Munich, Spiridione Brusina, of Agram, Jos. Szabo, of Buda Pest, C. Stahl, of Stockholm, Philippe de la Harpe, of Lausanne, Elisée F. Reclus, of Paris, Émile Cartailhac, of Toulouse, Ernest Chantre, of Lyon, J. J. Collenot, of Sémur, Henri Coquand, of Marseilles, Jules Gosselet, of Lille, Edmund Hébert, of Paris, Wm. Boyd Dawkins, of Manchester, Peter Martin Duncan, of London, A. H. Green, of Leeds, J. W. Judd, of London, John Morris, of London, Andrew Murray, of London, Wm. Whitaker, of London, and H. B. Medlicott, of Calcutta.

OCTOBER 2.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

The death of Dr. Edw. Roemer, correspondent, was announced.

Sensitive Stamens in Purslane.—Mr. THOMAS MEEHAN said the stamens of *Portulaca oleracea* were sensitive. They expanded when the flower opened, and, on being touched, rose slowly, though with some force, and embraced the pistil. On being again touched, they fell back to their former position. After having once gone through this upward and backward movement, they would not repeat it, so far as his observation went. It was better to use the lens to observe the motion on the growing plant in the ground than on a gathered specimen. He remarked on how much there was to observe in the common things around us, and yet the long time it seemed to take us to discover them. About thirty-five years ago, he said, he made the discovery of sensitive stamens in the common garden Portulacas the subject of his first contribution to scientific literature; and one would suppose that he himself at least, with this hint, would have examined the Purslane before now. He spoke of the relationship of *Portulacaceæ* with *Cactaceæ*. *Opuntia* had sensitive stamens, and with the same behavior in the same organs in *Portulaca*, essentially the same viscid juice, and tendency to succulence, there was little beyond an increased number and consolidation of parts in *Cactaceæ* to distinguish them from *Portulaceæ*.

Emigration of Solanum rostratum.—Mr. THOMAS MEEHAN exhibited a specimen of *Solanum rostratum*, collected by Dr. A. Gattinger, of Nashville, Tennessee, from waste ground about that city, where it had evidently established itself. It is a native of Colorado and contiguous territory, and is believed to be the plant which originally sustained the beetle *Doryphora decemlineata*, until it found a choicer article in the common potato. Mr. M. thought this the first case of its being found east of the Mississippi River. The potato beetle had in a measure forsaken it, and it was now following the beetle.

Dimorphism in Ailantus glandulosa.—Mr. THOMAS MEEHAN exhibited specimens of *Ailantus glandulosa*, gathered on the grounds of Mrs. Aaron V. Brown, of Nashville, Tenn. There were but six to seven pairs of leaflets forming the entire leaf, terminating in a pair, and not with an odd one, as in the normal form. The leaflets were roundish-oval, very oblique at the base, having

large coriaceous auricles, smooth and shining on the upper surface, and canescent beneath. The normal form has double the number of leaflets, which are narrowly lanceolate, and drawn out into a long narrow point. Nothing could be more unlike than the two forms. There were three trees near each other, among many hundreds of the normal form, all of which appeared to have come up in a measure naturally along fence rows in an old field. The broad shining leaflets gave the trees so marked an appearance as to attract attention from a long distance. They were seed-bearing (female) trees, as were many others of the normal form near them. It was, therefore, a great point gained to be able to show that the case was not one of sexual variation, to which many cases of dimorphism were properly referred. Another very interesting fact was that a branch of the normal form came out of one of the trees, and it was from this branch that the normal leaf now exhibited was taken. The laws regulating these variations seemed still obscure.

On the Feeding of Dinamœba.—Prof. LEIDY remarked that bias frequently proved to be an obstacle in the way of research. In his study of the rhizopods, he had repeatedly watched different kinds of *Amœba* for long periods with the view of ascertaining their usual mode of feeding. Ordinary experience had prepossessed him to direct his attention to the forepart of the body, that is to say, the part in advance in the movements of the animal, as the point at which food would be taken. He had been surprised at the rarity of the occurrence in which he had seen *Amœbæ* swallow food when the apparent greediness of the animal was taken into consideration. In the last number of the Popular Science Review, there is an interesting article, by Mr. P. Martin Duncan, entitled "Studies amongst *Amœbæ*." From this he learned, from the observations of Mr. Duncan, that the *Amœbæ* habitually take their food at what may be considered the posterior part of the body. With this hint, he examined specimens of the curious amœboid animal, described under the name of *Dinamœba*, of which he had recently obtained a good supply from the ditches of a cranberry field at Ateo, New Jersey. He had since on several occasions had the opportunity of seeing the *Dinamœba* take its food, which was done, as indicated by Mr. Duncan, at the posterior part of the body. One instance appeared to him to be particularly interesting, and was related as follows:—

Seeing a specimen of *Dinamœba* with its left side in contact with a filament of the alga *Bambusina Brebissonii*, he was led to watch it. On closer examination it proved that the alga entered to the left of the tail and extended through the body, causing a slight bulge of the ectosarc by its other end to the left of the head. The *Dinamœba* became slightly elongated, and the alga sunk more inwardly from behind. The former moved with an inclination to

the right, causing the alga to assume an oblique position from left to right. The anterior end of the alga suddenly protruded from the body of the animal, so that this appeared to be pierced by it. In this condition the alga entered the *Dinamœba* to the left of the tail, and protruded at the right of the head. Gradually the alga was made to assume a transverse position. The right extremity of the alga now became depressed and the left elevated, so that the alga assumed nearly its original position, in which it appeared to perforate the left border of the animal obliquely from the tail end. It gradually acquired a central position, penetrating the animal from tail to head. The *Dinamœba* now elongated at both ends, a third greater than its former length, extending in a fusiform manner upon the alga. The animal next doubled upon itself, so that both ends of the alga approached in front and protruded side by side from the head. One extremity of the alga then sunk within the *Dinamœba*, and subsequently the other extremity, so that the filament, about three times the length of the animal, became coiled up within it.

The observation of swallowing the *Bambusina* was made in the afternoon of September 15. In the evening, several hours after the first observation, on looking at the *Dinamœba*, which had been preserved in an animalcula cage, it was observed sitting, as it were, on a large filament of the alga *Didymoprium Grevilii*. The posterior end of the animal extended as a cylindrical expansion along the alga to a greater length than the breadth of the body of the *Dinamœba*, and so closely clasped it as to contract the gelatinous envelop of the alga to little more than the thickness of the green cells. After some time the alga suddenly broke, and the two portions were gradually bent backward and made slowly to approach, so as to become parallel with each other. One of the pieces was then drawn within the animal a convenient length, broken off, and completely swallowed, and this was followed by a similar movement of the other piece. Shortly after the first rupture of the alga, when the two portions projected at an obtuse angle from the back portion of the *Dinamœba*, the animal contracted in length, and discharged from the right side a mass of bodies, which consisted of the separated cells of *Bambusina*, probably from the filament it had swallowed in the afternoon.

Prof. Leidy continued that the two successive observations in the feeding of *Dinamœba* appeared to be particularly fortunate, as they apparently explained certain facts in the habits of the animal. *Dinamœba* had been noticed to be especially fond of the alga *Didymoprium*, for it was found to be present as the principal element of the food in numerous specimens. *Bambusina* was less frequently found among the food contents of the animal. The algæ were equally abundant in the localities of the *Dinamœba:* and, from the observations detailed, it would appear that the *Didymoprium* is preferred as food from the comparative ease with

which its filaments are broken into pieces of convenient size for swallowing.

The observations are, moreover, interesting from their indicating discrimination and purpose in the movements of one of the simplest forms of animal life. The movements are to be viewed as reflex in character, though resembling the voluntary movements by which the most intelligent animal would prepare morsels of food of convenient form to take into the mouth. In striking contrast were the movements, noticed on several occasions, by which an *Oscillatoria* obtained entrance into the empty shell of an *Arcella*, and there, coiled up, crept round and round incessantly.

Concretions resembling Bones.—Prof. LEIDY directed attention to some large specimens on the table which had been sent to the Academy for his inspection. They had been recently mentioned in the daily papers as bones of a large reptile found in the coal-measures of Hazleton, Pa. Though presenting a remote resemblance to bones, one of which especially looked like the coracoid of a reptile, they proved to be nothing but irregular nodules or concretions of iron ore, or limonite.

Mineralogical Notes.—Professor GEO. AUG. KŒNIG placed on record a determination of Ankerite from the Phœnixville tunnel. Professor Genth mentions the occurrence of this mineral at the Phœnixville mines in curved rhombohedral crystals, but usually in yellowish-white, crystalline, granular masses. An analysis by Dr. W. P. Headden is given (see below) (Prel. Report on the Mineralogy of Penna., 1875). The specimens from the tunnel present crusts, one-quarter of an inch thick, covered with brown, well-defined rhombohedrons, whose faces do not show any curvature. Underneath this brown crystalline surface the mineral is colorless, and possesses very brilliant vitreous lustre. Small cleavage pieces are perfectly transparent.

The angle of the rhombohedral pole edge was found by the speaker = 105° 59′, differing slightly from measurements of other localities, as 106° 12′ (Molls), and 106° 6′ (Ettling). The components of Ankerite are the carbonates of calcium, magnesium, and iron, whose rhombohedral angles are respectively 105° 5′, 107° 29′, and 107°. It is clear that the angle of a mixture of the three must lie between the extremes, and must occupy a distinct relation to their respective quantities. As those are known to vary between magnesium and iron, the angles must necessarily vary accordingly.

Specific gravity = 2.953, at 22° C.

The mineral was analyzed at the speaker's request by his assistant, Mr. R. B. Chipman, with the following result:—

CO_2	=	44.56	:	44	=	1.013 molecules
CaO	=	28.60	:	56	=	0.510
FeO	=	14.41	:	72	=	0.200
MgO	=	13.03	:	40	=	0.325
		100.60				

yielding the empiric formula—

$$Mg_3Fe_2Ca_3C_{10}O_{30}$$

also—

$$(\tfrac{3}{5}Mg, \tfrac{2}{5}Fe)CaC_2O_6$$

Dr. Headden's analysis (loc. cit.) gives—

$CaCO_3$	=	50.72	:	100	=	0.5072 molecules
$MgCO_3$	=	21.98	:	88	=	0.2497
$FeCO_3$	=	27.29	:	116	=	0.2352
Insoluble	=	0.22				
		100.21				

yielding the empiric formula—

$$Mg_3Fe_3Ca_{10}C_{20}O_{60}$$

also—

$$(\tfrac{1}{2}Mg, \tfrac{1}{2}Fe)CaC_2O_6$$

Hence, Ankerite occurs at Phœnixville in two varieties:—

At the mine with the ratio Fe : Mg = 1 : 1
In the tunnel " " Fe : Mg = 2 : 3

OCTOBER 9.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty members present.

Apparent Discriminative Power in the Selection of Food by a Heliozoon.—Prof. LEIDY remarked that he had on several occasions observed actions in the rhizopods apparently indicating a discriminative power in the selection of food. It was certain that they generally swallowed living algæ and animalculæ, and avoided dead ones. He recently had observed a heliozoon eject an article, which appeared to indicate discriminative power. The heliozoon was *Acanthocystis spinifera*. The genus differs from *Actinophrys* in being provided with siliceous rays in addition to the ordinary soft rays. The former emanate from minute disks, forming, as it were, a sort of flexible armor to the body of the *Acanthocystis*. While examining an individual, a rapidly moving, oval, flagellate infusorium, as it was supposed to be, came into contact with several of the soft rays. The infusorium was paralyzed; it assumed a globular shape and became quiescent. It was gradually drawn towards the body of the heliozoon, which projected its armor to meet it, but quickly withdrew it again, and the heliozoon was pushed off beyond the siliceous rays. The same movements

were repeated, and then the infusorian remained outside the siliceous rays. The objects were examined from time to time for several hours. The infusorium was no more drawn towards the body of the heliozoon. After a time it projected a minute bud, which gradually extended into a tortuous tube, proving the supposed infusorium to be a zoospore. It was finally abandoned by the heliozoon, apparently as if it had been determined not to be its proper food.

On Helminthophaga leucobronchialis (Brewster). — SPENCER TROTTER communicated the fact that last winter, while arranging the collection of warblers (*Sylvicolidæ*) in the museum of the Academy, he had discovered among them a specimen of *Helminthophaga leucobronchialis*. This rare species was described by Mr. Wm. Brewster, of Cambridge, Mass., who procured the first specimen at Newtonville, Mass., in the spring of 1870, a description and plate of which he published in the Bulletin of the Nuttall Ornithological Club for April, 1876. A second specimen was taken near Clifton, Delaware Co., Pa., in May, 1877, by Mr. C. D. Wood, an account of which Mr. Trotter sent to the Bulletin for July, 1877. The one now under consideration is, therefore, the third specimen of this rare species which has been discovered.

When he found it, there was no label attached designating its species, sex, or the locality where it was procured; but on the bottom of the stand was written "J. C., 20 Oct. 1862," and three other words that were much blurred, and which he believed to be "not from Bell." Bell is an Ornithologist of New York. The above indicates that John Cassin (for all the birds he examined have the same J. C. written on the stands or labels) had studied the specimen. The date he supposed to be that of its capture; and it is a curious fact that this specimen should have been procured at least eight years before the one from which the first description was taken. He had compared the specimen carefully with Mr. Brewster's description, also with Mr. Wood's specimen, and with these it agrees almost precisely. As the two former were males, from its similarity to them, he believed this one to be a male also. He took pleasure in adding another rare bird to the many which the Academy already possesses.

OCTOBER 16.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

Mineralogical Notes.—Professor GEO. AUG. KŒNIG placed on record the results of an investigation of a peculiar form of Magnetite from Magnet Cove, Ark. The material was obtained from

Dr. Lawrence through Dr. Leidy. It occurs in nodular masses, sometimes nearly spherical, with a very smooth surface, which not unfrequently is iridescent. There is no evidence whatever of crystalline form. The fracture is very even and straight, like a cleavage face. Color, black; lustre, vivid, metallic. It is thoroughly compact, and surpasses the crystallized Magnetite in hardness. It is strongly magnetic, attracting small fragments of itself. At Magnet Cove, collectors designate it as "rolled Titanium."

Specific gravity = 4.951 at 20° C.

B. B. Gives reaction of Titanium with salt of phosphorus, and fuses with difficulty.

Composition—

Fe_2O_3	=	64.47
Al_2O_3	=	3.06
TiO_2	=	3.25
V_2O_3	=	0.17
FeO	=	26.23
MgO	=	3.45
		100.63

This agrees perfectly with the general formula, $\overset{II}{R}\overset{VI}{R}O_4$, as follows:—

$\overset{II}{Fe}\overset{VI}{Fe}O_4$	=	84.52
$MgFeO_4$	=	7.73
$MgAlO_4$	=	4.16
$MgTiO_4$	=	3.90
$MgVO_4$	=	0.22
		100.52

OCTOBER 23.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

Remarks on Rhizopods, and Notice of a New Form.—Professor LEIDY remarked that, while in the Rocky Mountains last summer, he had continued his researches among the rhizopods. He had detected many forms, but they were nearly all of the same kind he had found in the vicinity of Philadelphia. His investigations led him to suspect that the species of fresh-water rhizopods were cosmopolite. He had found the greatest number of species and the greatest profusion near the sea level, though they were abundant even at an altitude of 10,000 feet in the Rocky Mountains. The most prolific localities of the fresh-water rhizopods are sphagnous swamps. Moist sphagnum often teems with multitudes of beautiful forms. A single drop of water squeezed from sphagnum

has at times been found to contain hundreds of individuals of *Hyalosphenia*, *Nebela*, *Euglypha*, etc., of different species. Ponds and ditches in sphagnous swamps are also rich localities for other forms. Ponds and ditches prolific in aquatic plants, in sandstone, quartzite, argillaceous, and granitic districts, have also been rich in rhizopod life. Ponds and springs in limestone districts are exceedingly poor, which is the more remarkable when we take into consideration the exceeding abundance of rhizopods in the ocean, and the vast contribution the ocean forms have made to the limestone rocks. Over and over again he had been disappointed in his expectation of finding rhizopods among the profusion of vegetation of some large springs in the limestone districts of our neighboring counties.

Among the peculiar forms of rhizopods found in the West is an interesting one obtained from a pond, at an elevation of 10,000 feet, in the Uinta Mountains, Wyoming. It was found in association with *Cyphoderia margaritacea*, which was first discovered in the Alps. It is also related with *Cyphoderia* in a manner parallel with *Centropyxis* as related with *Arcella*. In the side view it has the same shape as *Cyphoderia;* but, viewed in front or behind, it presents a conical process diverging on each side of the posterior third. The shell is yellow, chitinous, and incorporated with scattered particles of quartz sand. The mouth is circular, and surrounded by a delicate, colorless zone. The sarcode and pseudopods are the same as in *Cyphoderia*.

Length, 0.112 to 0.14 mm.; breadth between points, 0.08 to 0.124 mm.; breadth in opposite direction, 0.072 mm.; width of mouth, 0.028 mm.

CAMPASCUS CORNUTUS would be an appropriate name for the animal.

On Fossil Fishes.—Prof. LEIDY stated that the beautiful specimens of fossil fishes, presented this evening by Mr. Jeanes, were obtained from Bear River, Wyoming, and had been purchased by him in his recent trip west. They are some of the species named in Prof. Cope's communication to the American Philosophical Society last July.

OCTOBER 30.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-three members present.

Mineralogical Notes.—Prof. KŒNIG described a mineral from Bear Creek, Colorado. Dr. Joseph Leidy mentions Bergen's Ranch, 25 miles from Denver, as the more precise locality. The mineral occurs as a crust, one centimetre thick, on earthy Limo-

nite. The surface of the crust is mammillary in structure, and a cross fracture exhibits banded texture. No crystalline form is observable even when considerably magnified, but small fragments appear hyaline and transparent under the microscope. The color is light greenish-blue, and snow-white in spots. The mineral is friable between the fingers, and adheres slightly to the tongue.

Before the blowpipe the mineral is infusible, and imparts a strong green color to the flame. With salt of phosphorus and tin or charcoal, copper reaction. Decomposed by cold, concentrated hydrochloric acid, with separation of flocculent silica. Yields much water in the closed tube.

Composition—

	SiO_2	= 24.96
	Al_2O_3	= 33.85
	Fe_2O_3	= 0.31
	CuO	= 5.40
	P_2O_5	= 0.69
Comb.	H_2O	= 22.60
Hygrosc.	H_2O	= 12.30
		100.11

Supposing the copper to be present as $CuSiO_3$, one obtains the following very satisfactory ratio:—

SiO_2	=	21.06	0.700	:	1
Al_2O_3	=	34.16	0 666	:	1
SiO_2	=	3.90	0.130	:	1
CuO	=	5.40	0.131	:	1

The combined water gives 3 molecules respectively for the aluminum and copper silicate. Hitherto no notice had been taken of the large percentage of hygroscopic water, whence the 4 and 6 molecules have been deduced.

The mineral is, therefore,

$$\underset{\text{Allophane.}}{(Al_2SiO_5 + 3H_2O)} + \underset{\text{Chrysocolla.}}{(CuSiO_3 + 3H_2O)}$$

Two analyses from different parts of the crust gave the same result, and a rational relation between the two molecules (5 : 1) seems to exist.

C. Few Seiss, Miss E. B. Rice, Miss Mary B. Rice, Andrew J. Parker, M.D., J. D. Thomas, M.D., and S. H. Guilford, M.D., were elected members.

The following were elected correspondents: Sereno E. Watson, of Cambridge; Wm. G. Farlow, of Cambridge; Geo. L. Goodale, of Cambridge; John Duns, of Edinburgh; Dr. Ernst Candeze, of Liege; Dr. C. A. Dohrn, of Stettin; Baron E. Von Harold, of Berlin; Vicomte Henri de Bonvouloir, of Paris; Baron Maximilien

de Chaudoir, of St. Petersburg; Henry W. Bates, of London; Etienne Mulsant, of Lyons; M. A. Chevrolat, of Paris; S. Solsky, of St. Petersburg; Alfred Preudhomme de Borre, of Bruxelles; Jules Putzeys, of Bruxelles; Chas. C. Parry, of Davenport, Iowa; A. Ernst, of Venezuela; G. V. Black, of Jacksonville, Ind.; R. J. Lechmere Guppy, of Port of Spain, Trinidad; and Edw. Hull, of Dublin.

The following was ordered to be published:—

ON A NEW SPECIES OF HELIX FROM TEXAS.

BY WILLIAM G. MAZYCK.

Helix (Triodopsis) Henriettæ, Mazyck.

Shell rimately umbilicated, depressed, globose, rather solid, with numerous regular delicate striæ, dark brownish horn color; spire obtuse; whorls about five and a half, slightly convex; suture deeply impressed; beneath convex, smoother than above; umbilicus very deep, reaching the apex, but only exhibiting the last three whorls, grooved within; body-whorl gently ascending just behind the aperture, and then suddenly and shortly deflected, very much constricted behind the peristome, with two deep exterior pits, having the space between them elevated into a prominent ridge; aperture subtriangular, peristome much thickened within and very slightly reflexed, very tortuous, yellowish-white, furnished with a small denticle near its upper termination and an erect lamelliform tooth, which is equal in length to about one-fifth the diameter of the base of the shell, extending from the lower end of the uppermost pit almost to the inner edge of the body-whorl; low down in the mouth of the shell there is, between this tooth and the denticle, a large, white, tongue-shaped, concave tooth; and very near this, but rather lower down in the mouth of the shell, and on the base of the body-whorl, there is an oblique, stout, white tooth, which is sometimes slightly cleft on the edge. The parietal wall, which is covered with a semitransparent callus, bears a very strong, arcuated, entering, white tooth, whose outer margins form almost a right angle.

Diam. maj. $\frac{1}{2}$; min. $\frac{7}{16}$; alt. $\frac{1}{4}$ inch.

Habitat.—Eastern Texas. Mr. Jacob Boll.

This species more nearly resembles *Helix vultuosa*, Gld., than any other North American species, but differs from that shell in the shape and size of the umbilicus and in the form and armature of the aperture, which in *vultuosa* is lunate, almost circular, and in this species is rather V-shaped; in *vultuosa* the peristome, though moderately so, is decidedly reflexed, and its plane is almost entirely unbroken; in *Henriettæ* it is very much thickened, but scarcely at all reflexed, is very tortuous, and bears on its inner margin an obtuse denticle and a long lamelliform erect

tooth, which are wanting in *vultuosa;* in *Henriettæ* the two internal teeth are so far within the aperture as to be seen only on looking into it, while in *vultuosa* they are plainly visible from the base of the side; in the latter the parietal tooth is arched *upwards*, and its outer margin is rounded—in *Henriettæ* it takes the opposite direction, and its margins form almost a right angle; the deep pits behind the peristome are wanting or obsolete in *vultuosa*.

The species is referred to by Mr. Bland in "Remarks," p. 116–117.

NOVEMBER 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-one members present.

The deaths of John Gould Anthony and of Prof. James Orton, correspondents, were announced.

NOVEMBER 13.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "On the Diameters of the Incisors of Rodents," by John A Ryder, was presented for publication.

The Agricultural Ants of Texas.—Rev. H. C. McCOOK gave an abstract of a paper, in course of preparation, upon the Agricultural Ants of Texas, *Myrmica molefaciens*, Buckley (*M. barbata*, Smith). He had visited Texas during the summer, and, encamping in the midst of a large number of formicaries, had given several weeks to the study of these and the cutting ants. Mr. McCook referred to the first notice of the agricultural ants by Prof. Buckley, in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, and to the subsequent, much more detailed, observations of Dr. Gideon Lincecum. Notwithstanding the doubt with which Dr. L.'s statements had been received, Mr. McCook was able to verify many of his recorded facts, to complete many, to correct some, and to add new facts to the known history of these most interesting insects. The point chosen for study is in the neighborhood of Austin, Texas, upon the tableland to the southwest of the Colorado River and its affluent, Barton Creek. The soil is black and sticky, varying in depth from three feet to a few inches. The bed rock is limestone, which crops up in striated and punctured masses. The formicaries of the ants are very numerous, and are found along roads, in open prairies, in the very streets, sidewalks, gardens, and yards of Austin; one was even perceived in the stone-paved court of a hotel. They are, as found upon the hills, commonly flat, circular clearings, hard and measurably smooth, well enough described by Lincecum as "pavements." A few were found with low mounds in the centre, a few inches in height and two or three in diameter. These mounds were frequently composed of bits of gravel of one to two grains weight. The width of the formicaries varies from twelve feet to

two or three feet. They are invariably located in open sunlight. Yet the meridian heat of the sun is avoided, the ants ceasing work entirely at 12 M. and remaining housed until between 2 and 3 P. M. Very little work was done at night, except in cases where the nest had been disturbed. The process of making a clearing was observed, and suggested strongly the modes of pioneers in an American forest. "Stumps" of grass remained at the inner edge of the clearing; beyond these, ants were engaged cutting off the spires of grass. Generally the head was downward, mandibles applied quite close to the roots, and the stalk yielded under a combined process of cutting, pinching, tearing, and twisting. In one case a worker climbed to the top of the grass and gained the advantage of leverage by bearing down. The rank vegetation of the semi-tropical climate is kept in complete control; clearings were found among the tall thickets of wild sage and daisy which could not intrude upon the emmet preserves. From each formicary diverge roads in number from three to seven, widest at the home terminus, and extending for many feet—sixty feet, more or less—into the surrounding herbage. These roads are level and smooth, and in busy hours of the day are thronged by worker ants going and coming. The mode of gathering grain was completely observed, single insects having been followed from the nest to the harvesting grounds and back. Seeds were gathered from the ground, never from the plant. The seeds, which were collected in large quantities, were exhibited, and the report of the Botanical Section of the Academy upon the same, which had been made after careful examination by Messrs. Meehan, Burk, and Redfield, was read. The seeds were of small Euphorbiaceous and Rubiaceous plants, *Croton*, *Paspalum*, *Aristida stricta*, and *Buchloe dactyloides*, the common western buffalo grass. The last two named were the most numerous.

The chain of evidence that determines these ants to be true harvesters is as follows: 1st. Workers were seen gathering seeds and carrying them into the formicaries through the central gates. 2d. The same seeds were found in granaries within the opened formicaries. 3d. The same seeds with the outer shell removed were found in other granaries. 4th. The ants were found carrying out shells to the refuse heaps, which heaps, as reported by expert botanists from collections, contain no perfect seeds among them. Several observers, under Mr. McCook's direction, are noting the winter habits and the condition of the winter formicaries of these agriculturals, and, when these notes are complete, the entire paper will be given to the public. The reported sowing of a crop from year to year was considered, and so far confirmed that in many cases the clearings were found to be covered by crops of *Aristida*, which crops were as distinctly marked upon the clearings as a farmer's wheat or grass crop upon any particular field. The formicaries could be recognized at a distance by the circular mass

of tall yellow needle grass (*Aristida*). On the prairies and low land a sharp conical mound rises in the midst of a clearing more or less extensive. Specimens brought to Mr. McCook by Dr. Leidy, from Wyoming Territory, were identified as of the same genus, *M. occidentalis*, Cresson. Mr. Cresson had described the male as a separate species, *Myrmica seminigra*.

Several questions which arose were answered as follows: Why should the needle-grass (*Aristida stricta*) be planted upon the formicary clearings when seeds could be had all around the nest without that trouble? Evidently (if we are to suppose a planting) the saving of time and labor in harvesting thus accomplished might be a sufficient reason. Mr. McCook was unwilling as yet to commit himself to the theory of an intelligent planting of seeds by the ants. His opinion at present was that the ants simply preserve growths which accidentally arise from seeds carried out of the granaries for various reasons. It should be remembered that *only a portion* of the formicaries are thus covered, not one-half, perhaps one-third. Of twenty-two registered nests (in one list) in which the details are given in his field notes, ten are reported with needle-grass crops. This crop is usually on the margin of the clearing. Thus (extract from Notes), "No. 15. Space clear about one and a half feet diameter, needle-grass for two feet beyond on all sides. . . . . 18. Small space at the gate open. A circular belt of six feet, total diameter, covered with needle-grass. 20. Small hill; about twelve inches clear space, eight inches (each side) of needle-grass. . . . . 22. Four feet of clear space, gravel covering the space immediately surrounding the gate; tufts of needle-grass on outer edge. . . . . 2. Two feet diameter bare; about one foot each side covered with needle-grass. . . . . 4. Formicary four feet in diameter, with tufts of needle-grass." This will give a fair idea of the way in which the pavements run.

How did the naturalists of the last century account for the ancient sacred, classical, and popular opinion of the harvesting powers of ants, and how did they fall into the mistake of rejecting the ancient tradition? The mistake was doubtless due to the fact that no harvesting ants have yet been observed in northern Europe, whose naturalists gave tone to the natural history of the last century. The more widely extended research of very recent times has brought opinion back to the old channel. The origin of the opinion was accounted for by those who rejected it by supposing that the yellowish grain-like cocoons (the "eggs" of common speech) which ants are frequently seen carrying when nests are disturbed, were popularly mistaken for grains of wheat.

Is there anything like a systematic direction of these harvesting labors? Do the queen or major-workers, for example, oversee the work of the formicary? The queen has nothing to do (apparently) but replenish the population of the community. Her life is spent, for the most part, under ground. There are no "officers"

that could be distinguished. Each ant acts with an individuality and independence of behavior that quite accurately answers to that oldest description of her habits—(Prov. vi. 7) "Having no guide, overseer, or ruler." Each worker is a law unto herself, and yet the work moves on with perfect harmony, and as if with the utmost unity and system in management. The worker-majors act constantly as sentinels, and once or twice was observed what appeared to be an effort to extend aid to harvesters in gathering seeds; but nothing like leadership.

Mr. McCook then proceeded to describe the interior of a formicary, illustrating his remarks by various specimens preserved in plaster, plaster-casts, models, and drawings. Each formicary has one or more gates, rarely more than two, sometimes three. Sometimes two gates are found connected by a smooth, sunken track. The gates are circular openings at the surface. Within is a vestibule, shelving downwards less than or about 45°; it is about one to two inches wide, smooth, low, one-half to one-quarter inches in height, shortly diverging in tubular galleries connecting with granaries.

Accumulations of seeds were found within half an inch of the gate, more frequently lower down. Those described in detail were found one and a half inch from the surface. Stripping off the soil in horizontal layers, and working carefully with a trowel, Mr. McCook uncovered a series of oval, circular, and crescent or horse-shoe-shaped rooms, quite uniformly $\frac{1}{4}$ inch in height, but ranging to $\frac{3}{8}$ and $\frac{1}{2}$ inch. Of these, as examples, say, No. 1 was in diameters $3\frac{1}{2}$ by 4 inches; No. 2, $3\frac{3}{4}$ by $3\frac{3}{4}$ inches; No. 3, 6 by 3 inches. The roofs and floors were hard and smooth. In one nest opened in a light yellowish soil, and white "adobe," the black, unctuous "soil" had been brought down ten inches, and the floor, side walls, and roof plastered therewith. The upper granaries were covered with heaps of seeds, which must have nearly touched the roof. Narrow gangways were left at the outer margin between grain heaps and wall. The granaries were connected with each other by tubular galleries. The nurseries or rooms in which the larvæ and pupæ were stored, were of the same character as the granaries. One large nursery, ten inches below the surface, was illustrated by a model and plaster cast. It was exposed entire by careful and extremely tedious manipulation with knife and trowel. The difficulty of this and similar operations was greatly increased by the attacks of the ants, whose sting is quite as severe as the wasp's. Mr. McCook prosecuted these labors with one man and sometimes two constantly engaged in brushing off the enraged insects. The nursery was horse-shoe-shaped, the opening toward the centre of the nest, and one of the prongs directed in the line of the gates, with which it was apparently connected. The floor was hard, smooth, and plastered with the black top soil. The nursery was nine inches across the mouth, the length of the arms five inches,

being also about three inches wide at the mouth, and much narrower, three-quarters of an inch at the junction. Nothing but larvæ, pupæ, and a few callow ants was found in this nursery.

Section cuttings were made, and drawing and casts obtained. It was found that the granaries were arranged one above another from a quarter of an inch to three inches distant. There was a general tendency of the rooms to what may be called floors or stories, which was stronger or more regular in some formicaries than others. A cast and drawing showed how the rooms of each story are connected together, and the stories united with each other and the gates, by galleries. There was a massing of the granaries toward the centre, and an apparent preference for one half of the formicary space to the neglect of the other. Excavations were made several feet in depth, the queens, virgins, and males always eluding search, although the latter were in great number somewhere within the nest. One of the men assisting at the digging, said that in sinking a well he had found these ants coming out of their "holes" fifteen feet below the surface.

Some of the general habits of the ants were described, and their means of attack and defence were referred to, their stinging organs being explained, and the mode of inflicting the wounds, as well as effects, which are very severe, and continue for a day. In the case of children the sting is sometimes quite serious. The universal popular name of these ants in Texas is the "Stinging Ant." The mode of preserving the formicary from inundation by the massing of the workers in the vestibule and around the gates, was observed and described. He was not satisfied that this was the work of design, but it evidently served the purpose of partly stopping the influx of the water, not wholly. Examples were given showing strong intelligence in separating white meal from arsenic, with which it had been mixed, and of the refusal of poisoned molasses. A remarkable garnering by the agriculturals of a swarm of white ants, *Termes flavipes*, beaten down by a shower was described. These insects, males and females, were seized and carried in great numbers within the formicary. Reference was also made to the synonyma of these insects. Two years before Prof. Buckley's description as *Myrmica molefaciens*, Mr. Frederick Smith had described a female from Mexico as *Myrmica barbata*. It is probable that Mr. Smith's name will prove good, but the description, as compared with the insects, was not satisfactory. Moreover, the description of the supposed male in a private letter from Mr. Smith to Mr. Cresson does not at all answer to the Texas species. Not having seen Smith's types, Mr. McCook was still in doubt, and for the present retained the name given by Buckley. It is probable, however, that both the generic and specific names by which the ant has so long been known, must yield, and the name stand (as recently suggested in a private letter by Dr. Forel, the distinguished author of "The Swiss Ants") *Pogono-*

myrmex barbatus, Smith. However, the popular name given by Lincecum, "Agricultural Ants," will be permanent, except perhaps in Texas, where the people will doubtless continue to call the insects the "Stinging Ants."

Remarks on Ants.—Prof. LEIDY remarked that he had read Mr. Lincecum's communications on the habits of the agricultural ant of Texas with much interest, and that he was disposed to take a different view of some of his observations from the author. He considered the clearing of a space around the nest, with the exception of a grass that grew thereon, and the collection of the seeds of the grass when ripe, all very probable, but he suspected that the sowing of the seed was accidental rather than intentional. If the grass seeds are favorite food, many may be accidentally dropped and left on the clear space in carrying them from the surrounding region to the nest, and the lost seeds germinating may supply the future harvest field.

He further stated that, during his trips in the summer to the Rocky Mountains, he had observed, through the plains of western Kansas, Colorado, Wyoming, and Utah, formicaries of an ant, which he had suspected to be the same as the agricultural ant. Having submitted specimens of the ant to the Rev. Dr. McCook, he was informed they pertained to a different species, the *Myrmica occidentalis* of Cresson.

The formicaries of this ant include a circular space from three to eighteen feet in diameter with a central cone of less than one-third the diameter at base, and from ten to eighteen inches high.

The circular space is usually devoid of every vestige of vegetation, rarely presenting even the stump of a plant. Occasionally, however, it retains near its boundary some grasses, usually bunches of *Eriocoma* or *Triticum*. The space is mostly level and clear of loose soil, and if stony the pebbles are firmly impacted. The central cone is composed externally of small loose gravel stones, carried by the ants from the interior of the nest. The interior of the cone is composed of finer material, and is excavated into galleries. The finer soil forming the walls of these galleries is mingled with root fibres. These suggest the probability of being retained to give greater coherence to the friable soil. The larger stones on the exterior of the cone were found by weighing to be six times heavier than the workers who carried them to their place. The entrance to the interior of the formicaries consisted usually of one or two openings near the base of the cone.

The outside of the circular formicaries are closely and often densely skirted with vegetation, especially by sage bushes, *Artemesia tridentata*, grease wood, *Sarcobatus vermiculatus*, etc.

Accidentally, Prof. L. continued, he made an observation that rendered it probable the *A. occidentalis*, like many other ants, fostered insects for their saccharine productions. Noticing seve-

ral ants carrying what he supposed to be large stones into their nests, on closer examination these proved to be a large species of *Coccus*. A specimen of this insect was about the one-fourth of an inch long and the one-fifth of an inch broad, of a pale pinkish hue. The body, independent of the head, exhibited ten segments, of which the thoracic ones possessed short limbs ending in a single, black, curved unguis. The anterior pair of limbs were twice the size of the others. The antennæ were fuscous and eight-jointed. The source of the coccus was sought in the vicinity of the formicary, but not found. *Opuntia* grew abundantly in the neighborhood, but no cocci were upon it.

On a Stone Axe.—Mr. JOHN FORD presented fifteen species of fossil land and fresh-water shells, all of the quaternary period, a stone axe or celt, a sample of Lignite, and a bone, belonging to the genus *Canis*.

These were collected by himself and a friend in a cutting for a roadway made through the outer bluff on the margin of the Mississippi River, a short distance northwest of Alton, Ill. The axe, which is somewhat unique in form, has an especial interest, owing to the peculiar conditions attending its discovery. The roadway referred to is about twenty-five feet in width, forming a sort of terrace running parallel with the river, but some fifty feet above it. From the outer edge of this the bluff slopes to the water, while the inner edge is flanked by an escarpment composed entirely of natural deposits left *in situ* by the workmen. In height the latter is about equal to the width of the cutting, thus making the whole vertical measurement from the present surface of the river to the top of the bluff some seventy-five feet. It was in the face of this perpendicular wall, from three to five feet above the roadway, and twenty feet below the summit, that all the specimens under consideration were found.

The presence of land and fresh-water shells may be accounted for on the theory of deposition at a time when the Mississippi, or what is more probable, a great fresh-water lake covered that portion of the country, at an elevation much higher than the present river surface. The waves of this lake, dashing against the loftier limestone bluffs that still remain unaltered a few rods further inland, doubtless threw down myriads of land shells. This same force brought in large quantities of fresh-water shells, and these, mingling with the others, aided in forming the vast pile of debris of which the outer bluff is principally composed. The same theory may explain the presence of the wolf bone and Lignite, but it can reveal little or nothing in regard to the axe. The wall referred to presented in every part a solid front, without fissure or crevice, everywhere hard and impenetrable, except by pick or crowbar, and yet, twenty feet under the surface, within this stony matrix deposited by water thousands of years ago, laid the evi-

dence of the presence of the man of the period, a stone axe artistically made and doubtless used for purposes of battle. When or how it was buried is as much a mystery as is the history of its maker. Whether it was dropped from a canoe into the accumulating debris, or hurled from the land at a passing enemy, is a problem which cannot be solved; but that it had lain for unnumbered centuries in the sepulchre from which it was exhumed, there are abundant reasons to believe.

NOVEMBER 20.

The [illegible]ERGER, in the chair.

Thirty[illegible]

Correcti[illegible] Cretaceous Fossils."—The following [illegible]an Domingo, Oct. 15, 1877, was receive[illegible]:—

"In my [illegible] in the Proceedings for 1876, of which I [illegible], I find that, by some unaccountable m[illegible]*sus*, Conrad, is placed in the s[illegible]amily [illegible]*s* (p. 290), where it does not [illegible]*næ*, where it should be (p. [illegible] go, as is amply proven by the first pa[illegible] page, where I say 'I am by no means convinced that *Volutifusus* should be separated from *Scaphella*,' which it follows on p. 291. I do not pretend to explain or excuse this inadvertence, but desire to put the correction on record. I also note the following errata: In last line of page 289 for 'bi cit.' read 'loc. cit.;' page 279, line 14 from top, for 'larger' read 'longer;' page 305 under *P. elliptica* for 'seven' read 'my;' page 309, line 22 from bottom, for '*Pseudocardia*' read '*Protocardia.*'"

NOVEMBER 27.

The President, Dr. RUSCHENBERGER, in the chair

Thirty-eight members present.

A paper entitled "On the Alkali from the vicinity of Fort Bridger, Wyoming Territory," by Edw. Goldsmith, was presented for publication.

Remarks on the American Species of Difflugia.—Prof LEIDY remarked that the genus *Difflugia* was first described by Leclerc, in 1815, and was founded on three forms, of which one is referred by Ehrenberg to his *D proteiformis*, and the others to *D. acumi-*

nata and *D. spiralis*. Lamarck, without distinction, applied the former name to the whole of them.

In his study of the fresh-water rhizopods of this country, Prof. Leidy had recognized about fourteen kinds of *Difflugia*, which are sufficiently common and characteristic to be worthy of distinctive names. Nevertheless his investigations had led him to believe, with Wallich, that through transitional forms they all merge into one species.

The well-marked varieties observed are as follows:—

1. DIFFLUGIA PROTEIFORMIS. Ehrenberg.

This name, the oldest and first applied by Lamarck, is used with rather uncertain signification. It was suggested that it should be restricted to the variety having its shell spheroidal, ovoidal, or subpyriform, with circular transverse section and with the mouth circular and not crenulated.

2. D. PYRIFORMIS. Perty, Carter, Wallich, Ehrenberg.

3. D. ACUMINATA. Ehrenberg.

4. D. COMPRESSA. Carter.

5. D. ENTOCHLORIS.

Like the latter, but with the fundus of the shell surmounted by from one to three obtuse processes. Sarcode green. Is it *D. mitrata*, Wallich; or *D. triangulata*, Lang.?

6. D. URCEOLATA. Carter.

D. lageniformis, Wallich; *D. amphora*, Leidy.

7. D. OLLA.

Like the latter, but provided with several nipple-like processes to the fundus.

8. D. CORONA. Wallich.

9. D. LOBOSTOMA.

Mouth 3 to 12 lobed, spineless. *D. tricuspis*, Carter; *D. oblonga*, Fresenius; *D. crenulata*, Leidy.

10. D. GLOBULARIS. Wallich.

Exclusive of the varieties.

11. D. CRATERA.

Minute, goblet shaped, with ovoid body, and wide cylindrical throat.

12. D. VAS.

Resembling *D. pyriformis*, but with the neck narrowly constricted from the body.

13. D. SPIRALIS. Ehrenberg, Bailey, Fresenius, etc.

14. D. MARSUPIFORMIS. Wallich.

Including the variety *D. cassis*, Wallich.

In the Trans. Acad. Sciences, Berlin, 1871, Ehrenberg gives a list of upwards of one hundred named species of *Difflugia*, and later he described eight others. The list, however, includes most other related genera, except *Arcella*, so that if all were excluded except those pertaining to *Difflugia* in its restricted sense, the

number of species would be considerably reduced. It is remarkable that the long list includes less than half the species above named, nearly all of which appear to be very common. Further, most of those of our list mentioned in Ehrenberg's list are the least characteristic of the series. None of those named by Ehrenberg are suggestive of the forms called *D. urceolata*, *D. ulla*, and *D. corona*. Many of Ehrenberg's forms are badly figured and imperfectly characterized, and his lists appear greatly extended by the same things having been described over and over again under different names.

In Wallich's able papers on fresh-water rhizopods, referring to forms f[illegible] Bengal, the Himalayas, Greenland, Labrador, Nova Scotia, [illegible]ated about a dozen species of *Diffl*[illegible] in which the genus is now viewed, [illegible] all of these except, at most, two.

The Aeron[illegible].—Rev. H. C. McCook remarked that [illegible] warm day, with a soft wind from the west[illegible] day as would tempt young spiderlings to[illegible] The point of the following observations [illegible]he "Presbyterian Home for Widows," in [illegible]elphia. Stooping low, and glancing along [illegible]aught the sheen of myriads of fine silken [illegible] the sunlight. The tops of the grass spires, and the bushy heads of tall weeds were netted together by innumerable threads, and from many points of the same, like filaments were streaming out at various lengths into the air. Numerous small spiders, chiefly orbweavers, the young of *Tetragnatha extensa*, were rising from these plants, and sailing off over the field. But the finest exhibition of the aeronautic flight was seen along the post and rail fence which divides the meadow. The tops of the posts were the favorite spots, and upon all of these clusters of young wolf spiders (*Lycosidæ*) were gathered, sometimes eight or ten in a group. The purpose in choosing these elevated spots is quite apparent, the breeze being much stronger there than close to the surface of the earth, and consequently affording much better facility for flight. The presence of a deliberate and wise volition is all the more evident from the fact that the *Lycosidæ* are ground spiders, and are rarely found in such positions as the above. They had certainly mounted to the top of the fence with the settled purpose of taking advantage of the stronger breeze, and the better "send off" which the superior height afforded. He found that the threads, spread out by spiderlings on the grass stalks, which floated quite lazily, when the stalks were broken off and lifted higher, immediately fluttered off briskly, and soon carried the little arachnid away with them. Fortunately, the posts suited the observer's convenience quite as

much as the spiders', and he could easily notice the methods of the miniature balloonists.

The very top of the post was generally chosen as the point of ascent. The first position was to turn the face in the direction from which the wind was blowing. Then the abdomen was elevated to an angle of about 45°, and, at the same time, the eight legs were stiffened, thus pushing the body upward. In order to permit this movement, the claws were brought in somewhat, but not beneath the body, so that when the legs were stiffened the body stood high above the surface. From the spinnarets at the apex of the abdomen a single thread was exuded, and rapidly drawn out by the breeze, until, by reason of its delicacy, it was lost to eyesight. Four, five, even six feet of the line would at times be in view. Gradually the legs were inclined in the direction of the breeze, and the joints straightened out. The foremost pair of legs sank almost to the level of the post; and these especially, but indeed all the legs, and the entire attitude of the creature, presented the appearance of an animal resisting with utmost force and tension of muscles the effort of some superior power to snatch it away. Suddenly and simultaneously the eight claws were unloosed, and the spider mounted with a sharp bound into the air, and went careering away across the meadow, at a rate more or less rapid according to the velocity of the wind.

The utmost care was used to determine whether in this upward bound the volition of the spider had any further agency than the simple unclasping of the feet from the post. Owing to the extreme difficulty of such an observation, he could not speak with absolute confidence, but was able to satisfy his own mind that the aeronauts always vaulted upward and clear of the post at the moment of releasing their hold. That this was so in many cases, at least, he could hardly be mistaken. A similar action was frequently observed among the spiders before the final flight. Something was noticed a little like the frolicsome pranks of kittens or lambs. One would rush up to another, who thereupon would immediately change position, either by running or quickly vaulting to another part of the post. At times the leap would be made away from the post, but the buoyancy of the thread which had been exuded being insufficient to overcome the weight of the spider, instead of rising into the air, the creature returned to the post, or struck upon the adjoining rail. In these and similar movements, Mr. McCook was able to detect distinctly the vaulting action of the spider, and the eye, being thus familiarized with the movement, was less liable to be deceived in the more difficult observation of the quick spring at the time of the aerial flight. The posts and part of the rails adjoining were covered with threads adhering to the wood, and streaming out into the air. These were the result, in part, of the feints at flight just referred to; but were partly owing to another cause. The spiders, previous to

flight or vaulting, attached themselves to the post in the manner common to most of their order. The apex of the abdomen was thrust down upon the surface, and the liquid silk at the same time exuded from the spinnarets was thus caused to adhere thereto. As the creature moved away, the thread was run out into line and gave the spider a firm attachment. It was a question whether this anchorage is always made previous to flight, and whether the thread is cut immediately before the ascent? The observations made all pointed to an affirmative answer; but the matter was not positively settled.

The attempt was made to follow some of the aeronauts beyond the point of ascent. The difficulty of getting the object in position relative to the sun favorable for such observation, the motion of the air which carried most of the spiders upward, as well as the rapidity of the flight, frustrated many attempts. A position was finally taken beside one of the posts of the bars, which, being opened, gave a point of observation with the back to the sun, the eye upon the object, and a fair opportunity to follow it without the delay of leaping over a high fence, which before had been between the observer and the course of the spider before the wind. Fortune favored patience, and at last a spider took flight in a line which was little higher than the face. Following the arachnid at a moderate run, with the eye held closely upon it, it was observed that the position of the body was soon reversed, that is, the head was turned in the direction toward which the wind was blowing, instead of toward the point from which it blew, as before the ascent. Thus the long thread which streamed out above the aeronaut inclined forward, and at the top was in advance of its head. It was also observed that the legs were spread out, and that they had been united at the feet by delicate filaments of silk. The action by which this spinning work was accomplished was not noticed, owing to the smallness of the creature, the rapidity of its movements, and the difficulty of such an exceptional mode of observation. But the fact was noted. The reason naturally suggested for it is the increased buoyancy resulting from the increased surface thus offered to the resistance of the air.

The spider was followed for a distance of eighty feet, when it gradually settled downward upon the meadow. Before, or rather during this descent, a small, white, flossy ball of silk was seen accumulating at the mouth of the spider, which, with the peculiar motion of the forefeet, palps, and mandibles, at once suggested the drawing in of a thread. This behavior is not infrequent with spiders under other circumstances; but it became especially interesting at that moment, for at once it suggested an act of volition on the part of the lycosid, by which it, in a measure at least, might control its descent. Evidently the shortening of the overhanging thread operated like the furling of sails upon a vessel, and decreasing the motion of the spider, increased the influence of gravity

upon the body, which thus sank toward the ground. At the same time, the diminution of surface of the thread above, and the increase of bulk at the mouth, decreased the buoyancy of the whole, and allowed the creature to fall. Exactly the same effect was thus produced by the spider-aeronaut, and by a strikingly analogous mode, as the human aeronaut accomplishes when he contracts the surface of his balloon by causing the inflating gas to escape.

Some observations were made at the same time upon the aerial flights of several species of small orbweavers. These were stationed upon the tall grasses and weeds, from which innumerable cords of spider-silk were streaming, and upon which similar threads were twisted and meshed by the eddies of the wind, and the passing of the spiderlings from point to point. The attitude of most of these was one of expectation. Only two were observed in actual flight, and one of these was assisted. The nearness to the ground and the shelter of the surrounding herbage, may have retarded the process. However, this greater deliberateness is quite in harmony with the phlegmatic orbweavers, just as the energy of the *Lycosidæ* in mounting the fence, and their haste to be off, is characteristic of that group, who are, indeed, in their vigorous, stirring activities, quite typical Americans. The little orbweavers were hanging upon the lower part of the floating strings near the point of attachment to the grass. Their backs were downward and their heads outward or toward the free end of the thread. The first, second, and fourth pairs of legs were stretched along the thread, and the third and shortest pair were held off, curved, the feet apparently united to the main thread by taut filaments. This position, so far as could be determined, was maintained after flight. In some cases a series of two or three puffs or pellets of floss were gathered around the thread between its free end and the spiderling. They were generally cone-shaped, the apex toward the spider. In form they were not unlike the pellets which one used to see gathering upon the roll of wool as it passed from the fingers of our maternal ancestors into the whirling "flyers" of an old-fashioned spinning wheel. Perhaps they may have been wrought by a similar process, the twisting of the loose thread through the action of the wind, and the counteraction of the spider.

The above observations were the most complete and satisfactory which Mr. McCook had been able to make, but he referred, in further illustration and confirmation of these, to the results of observations and experiments of several previous years. In the closing days of October, if the weather have the usual mildness of that period, these aerial flights may be seen from almost any open spot of country-side. The 29th of October, 1875, was especially remarkable for the exhibition of this habit. All the young of the spider-fauna seemed to be afloat. It was like the simultaneous outbreaking among our children of the annual fury for

special games, marbles, tops, jumping rope or hoop. The air was filled with floating filaments of spinning-work. Passing along the public squares of Philadelphia, Mr. McCook arrested and examined some of these; the prevalent, indeed it might be said, the unvarying type, was the single thread, long, with a flossy tuft of irregular form, but commonly hammock-shaped, at or near the middle of the line. A small dipterous insect was found entangled upon one of these threads. Fairmount Park was filled with these excursionists. All day long the filaments were floating across the Schuylkill River, entangling with the decks and smoke-stacks of passing steamboats, and with the persons of passengers and crews. One of the latter caught a number of the threads, on which he found small spiders, and on three threads little flies. The next day Mr. McCook saw some of these attenuated balloons float across the river at a height of from 60 to 70 feet, and entangle with trees upon the high bluff. The temperature, however, had fallen several degrees, and comparatively few of the aeronauts were afloat. The floating filaments while in motion preserved generally a crescent or horse-shoe shape, the "horns" or forks nearly equal in length or not greatly unequal, and pointed toward the direction of the wind. At or near the point of curvature or divergence was the puff of floss or "basket" as it might, perhaps, be called.

Mr. McCook, in conclusion, referred to experiments which he had made afield and from his study-window with young spiders, particularly the young of *Agalena nævia*, the speckled tubeweaver. When let loose into the air from the finger-tip, the spiderlings floated out by a single thread which was always and instantly first attached to the finger. At first, the head was outward, the abdomen being toward the hand, from the apex of which the long superior spinnerets diverged. Presently the little creature turned and cast out a thread behind, when, if permitted, it would usually clamber up the original thread to the finger. When this was broken off, the spider, seated midway of the two filaments, floated off and outward, and was lost to sight. Again, by an eddy of the air, the thread would be thrown backward and upward and catch against the wall upon which the little voyager would anchor. At other times, much to his surprise, after the thread had been quite lost to view, and the spider was supposed to be far away upon its flight, it would descend, as from the clouds, and send out its silken grapnels against the observer's cheek or nose. The will of the little spider seemed to have no control over these movements, which apparently were always wholly at the mercy of the wind. However, the manner of accomplishing the aerial flight by means of the buoyancy of a single thread, or rather of two threads united at or near the middle, was quite in accord with the methods above described. Reference was also made to the remarks of other observers which were compared with those here given.

A. H. Franciscus, Henry Pemberton, Jr., Henry Cope Haines, Oswald J. Heinrich, and Wm. R. Wharton were elected members.

Dr. H. Halloway, of Laporte, Ind.; Dr. Robt. Wiedersheim, of Freiburg i. B.; Carl Semper, of Würzburg; Chas. Brongniart, of Paris; and George Bowdler Buckton, of Weycombe, Haslemere, England, were elected correspondents.

The following was ordered to be printed:—

THE SIGNIFICANCE OF THE DIAMETERS OF THE INCISORS IN RODENTS.

BY JNO. A. RYDER.

Upon making sections of the cutting or incisor teeth of various species of rodents and rodent-like animals, it is observed that a great disparity exists amongst the various forms in respect to the ratio of the antero-posterior to their transverse diameters. This character is sufficiently marked to divide the order into two sharply-defined groups as follows:—

a Incisors wider than thick;[1]
b " thicker than wide.

A number of species falling under the definition of group *a* may be arranged in a series in which the final terms approach group *b*, thus, *Mesotherium*, *Lepus*, *Lagomys*, and *Phascolomys*, the marsupial. In the same way, a series may be arranged which shall represent a gradual intensification of the character as indicated in the definition of group *b*, thus, *Castor*, *Lagostomus*, *Cavia*, *Mus*, *Calamodon*, and *Anchipodus*, amongst Tæniodonts; *Sciurus* and *Cheiromys*, amongst primates. The curvature of the upper incisors in group *a* is greater than in *b*, that is, an arc which will coincide with their curvature is the segment of a smaller circle; in both groups the curvature of the lower incisors is less than that of the upper ones. In the last and extreme type of group *a*, the antero-posterior diameter of the lower inner incisor is to its transverse as 1 is to 3; conversely, in the extreme forms of group *b*, the antero-posterior diameter very greatly exceeds the transverse, the ratios being as 3, or even more, is to 1. These contrasts become visually apparent in the cut, where the diagrams of cross-sections of incisors of rodents and rodent-like animals all stand in the same position with reference to fore and aft and lateral directions.

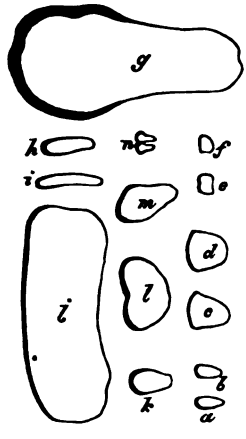
The two groups may be further distinguished as follows:—

a Gnawing apparatus not so powerfully developed or specialized;
Temporal muscles feeble, or inserted very close to condyles;
Crowns of incisors widely separated from pterygoid processes;
Incisive alveoli extending as far as, or a little further back than, the symphysis mandibuli.

[1] This grouping, it should be remembered, is entirely morphological.

b Gnawers of hard substances; incisors greatly developed;
Temporal muscles and pterygoid processes strongly developed;
Crowns of incisors relatively near pterygoid processes;
(Masseters greatly developed, *Castor*);
Incisive alveoli extending beyond symphysis mandibuli, and often reaching to the base of the pterygoid processes.

The diametrically opposite structural characters pointed out signify more or less diametrically opposite habits. The genera of group *a* have relatively weak incisors as compared with those of *b*, which is in obvious correlation with the feebleness with which they manifest the gnawing habit. Whatever may have been the ways in which the incisors of *Mesotherium* were used, it is very evident that they could never have been used in the same way as those of the squirrel and beaver. They appear to have been wholly adapted for cropping herbage, and not in the slightest degree for gnawing. The *Leporidæ* and *Lagomyidæ* with their feeble incisors have also a very moderately developed gnawing habit, which is in accordance with the weakness of their incisive mechanism. The presence of an accessory pair of incisors of weaker development in the lower jaw of *Mesotherium* and in the upper jaw of the *Leporidæ* and *Lagomyidæ*, the deciduous outer, upper, and lower pairs in *Cheiromys*, the apparent continuity of the incisive with the molar series in the *Tæniodonta*, give us a hint as to the probable manner in which the evolution and functionalization of the median anterior pair of teeth (incisors) came about in the gnawers and aberrant gnawing forms of other orders.



a, cross-section of a lower, *b*, of an upper, incisor of the squirrel; *c*, do. of a lower, and *d*, of an upper, incisor of the beaver; *e*, do. of an upper, and *f*, of a lower, incisor of the hare; *g*, cross-section of a lower incisor of *Calamodon simplex* (after Cope); *h*, do. of an upper, and *i*, of a lower, incisor of *Cheiromys*; *j*, do. of an upper incisor of *Mesotherium cristatum*; *k*, do. of an upper incisor of *Cœlogenys*; *l*, do. of an upper incisor of *Hydrochærus*; *m*, the form of the obliquely worn face of an upper incisor of *Phascolomys*; *n*, cross-section of both upper incisors of *Cavia aperea*. The anterior portions of the sections look towards the left hand.

It may be said, in a general way, that the excess of the antero-posterior diame-

ter of the chisel-like incisors of group *b* over their transverse one is in obvious correlation with the hardness of the substances which they are designed to cut. The illustrations which verify this assumption are sufficiently striking to make the principle clear. I will cite but four. The beaver is notorious for the magnitude of the work he will accomplish with his busy jaws and incisor teeth, which are in the form of curved, subtriangular prisms: a form well adapted to secure strength, and frequently met with amongst the cavies, porcupines, and chinchillas, though, in the latter, a cross-section often approaches more the form of an [illegible] with its most acute angle pointing in a back[illegible] his form of tooth, of course, has the same me[illegible] to resist breaking strains as that with the sides a[illegible] as in the squirrel. Incisor teeth, pyriform in secti[illegible] in the guinea-pig and the fossil Tæniodont *Calam[illegible]* like the last, has similar mechanical advantages. [illegible]el,[1] with its power of gnawing the exceedingly hard [illegible]f nuts to obtain their nutritious contents, is a sec[illegible] example. The destructive abilities of mice and rats are [illegible] the form of their incisors and powerful masseter muscles. [illegible]stly, *Cheiromys*, the insectivorous lemurine primate, beaver-like, gnaws open the burrow of its prey, the larvæ of wood-boring insects. The incisors of this group, constructed, as they are, with reference to the use of the least amount of material, are still further strengthened by their form; that is, they are curved in such a way as to cause the lines of greatest strain to pass longitudinally through a great part of the mass of the tooth. This end is attained in the beaver and squirrel by an admirable arrangement of the masseter muscles, the fibres of which are disposed in lines parallel to that of the greatest strain exerted upon the lower incisors. This arrangement of muscular fibres also admits of the application of the

[1] One African species is reported as gnawing ivory, by M. Du Chaillu, but only on the authority of the natives. He has named it on this account *Sciurus eborivorus* (see Proc. Boston Soc. Nat. Hist. vol. vii. p. 363). Prof. Cope informs me that, on the plains, the fallen antlers of deer are gnawed by rodents; and some assert that they are entirely eaten up in this way, which is held to account for the infrequency with which they are ound where many thousands are annually shed.

whole of their power without mechanical loss, which would not be the case did not such parallelism exist. Whatever strain passes transversely through the teeth, and which may more properly be regarded as breaking strain, must pass through their long diameter; in this way the same mechanical advantage is secured as where a builder places a horizontal beam in such a position that the greatest strain shall fall through its greatest diameter.

The foregoing facts may then be interpreted thus:—

1. Where the incisors are wider than thick, the gnawing habit is feebly developed.

2. Where the incisors are thicker than wide, the gnawing habit is greatly developed.

That is to say, a certain manner of using the incisor teeth (to gnaw) has been a continuous stimulus to which growth force has been as continuously responsive. The opposite forms of development have thus been the result of stimuli differing in kind and degree. According to this view, plastids are brought in increased numbers wherever an increased amount of work is to be done, while at the same time an increased waste of structure is going on, solely by the operation of the above causes, while those causes are in and of themselves wholly passive. Illustrations immediately occur to us where we have the working of such principles displayed: in muscular work, *massage* and alterations in the form of parts due to the establishment of new and approximately normal relations with the environment, as happens in unreduced dislocations and fractures; the thickening of the epidermis of the knee, as on the sole of the foot, and due, like the last, to frequent and similar contact with the earth as a passive stimulus.

The significance of accessory rudimentary incisors present in some forms of true rodents, as pointing to the manner in which the evolution of the rodent type of dentition took place, may be overrated, yet, when it is borne in mind that in other groups the appearance of diastemata between the different kinds of teeth took place gradually, and in a way which unmistakably shows the gradual steps of the process, we may be excused for thinking the same to have been the case here, although without positive, tangible evidence in the shape of intermediate fossil forms that exhibit such a passage from the ordinary type. We have four instances pointing towards a progressive functionalization of

the median pair of incisors as gnawing teeth, and this, taken together with the evidence yielded by their forms in section, induces us to venture the reflection that the more severe strains to which they were subjected by enforced or intelligently assumed changes of habit were the initiatory agents in causing them to assume their present forms—such forms as were best adapted to resist great strain without breaking. I am aware that this relation between function and structure, in the case of the incisors of rodents, has been pointed out long since, but it seems to have been coldly received by most anatomists, perhaps because not in accordance with the theory of special creations. Not wishing to discuss the merits of such an objection, it seems to us far more reasonable to believe that organisms are gradually shaped (modified, transmuted) by forces under the surveillance of an orderly reign of law, *i.e.*, to a series of mechanical causes producing morphological effects, than to reso[illegible]o an endless chain of special expedients to account for the facts.

In respect to the changes in the mandibular articulation and muscular motor apparatus of the [illegible]vs of *Rodentia*, I venture to suggest that these have had ar[illegible]gin similarly due to enforced or intelligently assumed chang[illegible] the mode in which their functions were exercised. The molar teeth have also been modified by the same agency, as will be shown elsewhere.

DECEMBER 4.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

On the Introduction and Disappearance of Plants.—Mr. ISAAC C. MARTINDALE spoke of the appearance of plants in certain localities, where, heretofore, they had not been detected, and of their disappearance from sections where formerly they were quite plentiful. He stated that *Pinus mitis* was at one time abundant in this region, and extended northward into New England; but that it was believed now to have entirely disappeared from its northern localities, and it was thought by some persons to have disappeared from New Jersey also; he had, however, detected one tree near Gloucester City the past summer, and had recently found on a high edge of ground near Moorestown a strip of woodland, which contained a large number of trees, nearly all of which were from eighty to one hundred feet in height, and eighteen inches or more in diameter at the base; a few trees of the same species were growing in an adjoining field, where, the owner of the land informed him, grain had been harvested in the early part of the present century, showing the growth of wood to have been very rapid. On examining these trees he found evidence of a periodicity in their fruiting; it being well known that the species of pines in this section require two years to perfect their fruit. This year a considerable number of cones had set on the branches, but those which formed last year, and were now full grown, were very few indeed, and the mass of cones which were first noticed were chiefly those which matured last year or before, and had long since opened and discharged all of their seed. As is well understood among farmers and nurserymen, apple-trees do not produce abundantly every year, but seem to have periods of great fruitfulness. He thought a similar condition existed in *Pinus mitis*, which might be offered as one reason for its gradual disappearance, it being evident in view of the doctrine of "the survival of the fittest" that a tree which formed fruit once in two years, which fruit required two years to come to maturity, could not maintain a position as if the conditions were otherwise. Should any of the occurrences of early or late frosts, severe drought, an extreme degree of rain-fall, prevail on the fruit-bearing years, which would not be an unusual thing, it is apparent that the chances of perpetuating its kind would be lessened in a corresponding degree. As evidence of these conditions having to some extent existed in the past he found that but very few of the seeds which have been perfected had germinated so as to produce young trees; the greater

part of the trees now standing appeared to be on the decline, and when they are gone there is but little to build a hope on for a succession of the same species.

Circumspection of Ants.—Professor LEIDY remarked that, a number of years ago, he had been led to an observation on the little red ant, sometimes a great pest to our dwellings, which would indicate a ready disposition to become circumspect. When he purchased his present residence, while it was undergoing some repairs, he noticed a fragment of bread, left by a workman in one of the second-story rooms, swarming with ants. Apprehending that the house was seriously infested, to ascertain whether it was so he placed a piec[illegible] y room from the cellar to the attic. At noon[illegible] covered with ants. Having provided a cu[illegible] h piece was picked up with forceps and th[illegible] oil. The cake was replaced, and in the even[illegible] overed with ants. The same process was gon[illegible] ng two days, morning, noon, and night. The thir[illegible] r of ants had greatly diminished, and on the fou[illegible] none. He at first supposed the ants had all be[illegible] in the attic he observed a few feasting on som[illegible] s, which led him to suspect that the remaining ants h[illegible] uspicious of the sweet cake. He accordingly distribute[illegible] the house pieces of bacon, which were afterwards fou[illegible] ng with ants. This was repeated with the same result for several days, when, in like manner with the cake, the ants finally ceased to visit the bacon. Pieces of cheese were next tried, with the same results; but with an undoubted thinning in the multitude of ants. When the cheese proved no longer attractive, recollecting the feast on dead flies in the attic, dead grasshoppers were supplied from the garden. These, again, proved too much for the ants; and, after a few days' trial, neither grasshoppers nor anything else attracted them; they appear to have been thoroughly exterminated, nor has the house since been infested with them.

DECEMBER 11.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-six members present.

DECEMBER 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The death of John McAllister, Jr., was announced.

A Dog with Supernumerary Toes.—Mr. RYDER remarked that he had recently seen a dog with five toes on both hind feet, but upon a careful examination it was found that the metatarsals of the extra inner toes were entirely absent, there being no apparent vestige of a metapodial ossification in the pouch of skin that supported the distal ungual bone with its nail and that connected these with the tarsus. They seemed to hang rather loosely, and to be rather in the way than of any use. In the absence of metatarsals, and indeed of all appearance of ossifications, except the ungual ones, they differed from somewhat similar abnormal conformations of feet in dogs, figured in DeBlainville's *Osteographie*, where one is represented with six toes, there being two extra inner ones.

Rhizopods in an Apple-tree.—Professor LEIDY remarked that, a couple of weeks ago, at Swarthmore, while waiting for the railway train to return home, his attention was attracted to a large apple-tree which, shortly before, had been prostrated by a storm. In the fork of the trunk there was a bunch of moss which he collected and took home. On washing the moss and examining the water, he was not a little surprised to find in it many rhizopods. Of these, one was *Difflugia cassis*, and was abundant. Another was *Difflugia globularis*, few in number. The others were *Trinema acinus*, *Euglypha alveolata*, and *Euglypha brunnea*. The position of these animals, in the moss on the tree, was about eight feet from the ground.

DECEMBER 25.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-five members present.

The following reports were read and referred to the Publication Committee:—

REPORT OF THE PRESIDENT FOR THE YEAR ENDING NOVEMBER 30, 1877.

It is well known that the Academy of Natural Sciences of Philadelphia had its origin in an opinion of its founders that the association of those disposed to devote their spare hours to a study of natural objects and the laws under which they exist, would be advantageous to all who might engage in it. Their purpose was to form a society composed of persons who desired to acquire knowledge, and impart it to each other and the public. The founders believed that a union of those whose tastes were alike in this sense would be a source from which each member might derive something which, separately, they might not be able to gain. Any one desirous to learn, or willing to assist others to learn, was, and is still, considered eligible to membership; no degree of proficiency in natural science was or is an essential qualification.

The Society assumed the name of Academy because it signifies a place to learn, a school, a resort of learners.

From its foundation the Academy began to form a library and collections of natural objects for the common use of its members, as well as of others interested in the acquisition and diffusion of knowledge of the works of the creation. To acquire and increase the means of facilitating the labors of students has always been a primary object. Its members are all volunteers, willing to give money, or time, or labor for the advancement of the common cause. The work they have done has always been spontaneous, self-imposed, and, in its ultimate object, benevolent and charitable, if it be charitable to add to the stock of knowledge for the free and common use of mankind.

Very many are indebted to this Academy for initiation into paths which have conducted them to distinguished positions in scientific explorations and surveys, in colleges and universities, positions which they might not have been able to qualify themselves to fill without those facilities of study which this institu-

tion affords freely to young aspirants. A list of names of those who have become distinguished naturalists through the agency of this Society, would indicate the extent of benefit it has conferred in this sense.

That the course heretofore pursued by the Academy has been generally satisfactory is proved by the liberal contributions of materials and money which it has received from time to time from very many of our public-spirited fellow citizens. It seems reasonable to suppose that observance of the general policy which has been successful in the past is calculated to secure the confidence and encouragement of the public in the future, upon which the continued prosperity of the society mainly depends.

I have the pleasure to state that during the past year the general progress of the Academy has been steady, tranquil, and satisfactory. The attendance at the stated meetings indicates that interest in scientific investigations has not abated. The average number of members present at each meeting through the year is thirty-two. The extent and value of work done by the members may be fairly estimated by reference to the published record of Proceedings.

Through exchanges with kindred societies, the liberality of authors and editors, and the beneficence of the I. V. Williamson Library Fund, and the Thomas B. Wilson Library Fund, numerous and valuable additions to the library have been made. The number of members and others who consult the library, it is believed, has increased.

More than five thousand persons, besides those introduced by members or otherwise, have visited the museum, to which many valuable gifts have been made.

The steady growth of the museum clearly indicates that the building should be completed as soon as practicable. In this connection a committee was appointed in February to apply to the State of Pennsylvania for assistance. The application made was not successful, but it is hoped that at the approaching session of the Legislature the claims of the Academy to the fostering care of the State will be favorably considered.

I respectfully suggest that the invitation given last December to the executive officers of the State and members of the Legislature individually to visit the museum and library as frequently during the year as might be agreeable to them, should be re-

newed, that they may have opportunity to become acquainted with the character of the institution by personal observation.

The officers and members of the Zoological Society of Philadelphia have been invited to participate in the proceedings at the stated meetings of the Academy whenever they might desire to submit for consideration any subject of zoological interest.

At the stated meeting of the Council in April, Dr. J. Gibbons Hunt, on the unanimous nomination of the Biological and Microscopic Section of the Academy, was duly elected Professor of Histology and Microscopic Technology.

Early in May, Professor Hunt formed a small class, and delivered a course of lectures which were well received; the fees paid on account of them were not equal to the necessary expenditure.

This experiment has demonstrated, in my opinion, that the scheme of establishing professorships and systematic teaching in connection with them, cannot be realized until endowments sufficient to defray incidental expenses and compensate the professors have been provided. The purpose of the proposed professorships is to enable the incumbents of them to devote their whole time to advance the interests of science by taking entire charge of the collections pertinent to their respective departments, by engaging in original research, and by giving systematic courses of instruction. To enable them to do this, they should receive compensation sufficient to render them independent of any other employment for a livelihood. Persons properly qualified to fill these proposed positions are not likely to be engaged at an annual salary of less than from two to three thousand dollars. It is vain to expect the plan to be realized, desirable as it is, until ample means are provided.

The Sections of the Academy are now performing some of the duties assigned by the By-laws to the professors. They relieve the Curators of the details of arrangement and classification of those departments of the museum which are appropriate to their respective pursuits.

In January the Mineralogical Section, and in February the Physics and Chemistry Section were formed and accepted by the Academy.

At present there are six Sections of the Academy, namely—

The Biological and Microscopic Section.

The Conchological Section.
The Entomological Section.
The Botanical Section.
The Mineralogical Section.
The Physics and Chemistry Section.

A list of the members and correspondents of the Academy, made up to June 30, 1877, has been printed and distributed. Although unusual care was taken in the preparation of this list, it is not presumed to be free from errors. Probably there are names misspelled, some omitted, and some retained which should not be.

On the 30th of June, 1877, it is believed the number of living members was 835, and, as far as ascertained, the number of living correspondents 507. Of these, 297 are foreign, and 210 are residents of the United States.

During the year 43 members have been elected, 18 have resigned, and 12 have died, indicating an increase of 13 members.

The number of correspondents elected during the same period is 71. The death of 7 has been reported. It is conjectured, however, that some have died whose demise has not been communicated to the Society.

The attention of members and correspondents is respectfully invited to this list, and they are requested to report to the Recording or to the Corresponding Secretary such errors as they may discover in it. If they will report also changes of residence or post-office address they will contribute largely towards rendering future editions of the list accurate.

The Biological and Microscopic Section of the Academy held an annual exhibition on Monday evening, November 19th. About 300 objects were shown under 120 microscopes, many of which are remarkable for perfection of construction. The museum was open on the occasion. It is estimated that not less than 3000 visitors were present during the evening.

The financial condition of the Society is always interesting. I have the pleasure to state that at present the Academy is free of debt. But its resources do not insure its freedom from pecuniary inconvenience, nor authorize indifference to the ways and means of providing sufficiently for future wants.

It is well known that the origin, progress, and present condition of the society are due to the benevolence and charity of many in-

telligent and liberal individuals exerted in its favor in the course of the past sixty-five years. All the possessions of the institution are from charity, and they are all used for the charitable purpose of increasing and diffusing knowledge of the natural sciences.

The library and museum have acquired such sturdy proportions that their preservation and maintenance require now a very considerable annual expenditure, which must increase with their growth. Properly cataloguing the continuous additions to the library, and promptly mounting, labelling, and displaying specimens in the museum as fast as presented, can no longer be safely confided to volunteer and gratuitous labor alone. There is constant occupation for two or more experts, for whom a reasonable compensation is essential.

Janitors must be paid. Fuel, light, water-rent, freight, stationery, repairs, etc. etc., amount to a considerable sum in the aggregate.

Exclusive of trust and special funds, the semi-annual dues of members and the small fee demanded from the general public for admission to the museum are the chief resources of the Academy. They have not been equal to the current expenses of the year.

The Council has not been inattentive to the Academy's pecuniary condition. As precautionary measures the current expenses were carefully examined and reduced as much as was deemed fairly practicable; and a circular was addressed to the members individually, asking contributions towards raising means to meet an estimated deficiency. This appeal has been liberally answered by the generous, and it is confidently believed that all demands against the Society will be promptly satisfied.

Measures should be devised to avoid the necessity of resorting to such expedients in the next and subsequent years. It is possible that annual appeals for help may weary the community. The ordinary income should at least equal, if not exceed, the necessary expenditure.

Exclusive of the expenditures on account of increase of the library, and the publication of the Journal and Proceedings of the Academy, the annual expenses necessarily exceed $5000.

The estimated annual income is—

From members' dues	$2890
" initiation fees	300
" admission to the museum	500
" Thos. B. Wilson fund, towards librarian's salary	300
	$3990

The annual income is not uniformly equal. Some members have failed to pay their dues for this year, and some for several years past, a failure which may be possibly ascribed in part to the general stagnation of business that has so long prevailed in the community.

It is presumed that the dues required from members, if punctually paid, will defray the current expenses, and enable the Academy to secure to them the privileges of membership without additional liability. Life-members, that is, those who commute the semi-annual dues by a single payment, are entitled to the same privileges.

If all members were to avail themselves of the right to become life-members, an important source of income would become extinguished, and, for a time, the Academy might find it difficult, if not impossible, to provide the ways and means to meet its necessary expenses. But it would not be released from its implied obligation to members to secure to them their stipulated privileges (By-laws, Chapter IX.).

The economical or personal advantages of life-membership become apparent from an examination of the list of members. The cost of a life-membership is equivalent to the payment of ten years' dues.

The printed list shows that—

5	have been members	between 60	and 65 years.
10	" "	50 "	60 "
15	" "	40 "	50 "
29	" "	30 "	40 "
124	" "	20 "	30 "
285	" "	10 "	20 "
367	" "	10 and less.	

Four hundred and sixty-eight members, or more than one-half of the whole number, have survived their election considerably beyond ten years.

The advantage of life-membership is so evident, that it may be expected that all who are able will avail themselves of it. As long as the moneys received for life-memberships are securely funded they are no less advantageous to the Academy than to the member. If spent as fast as paid they serve to diminish an important source of revenue without lessening the expenditure, or obligations of the Academy to its members.

Prior to May, 1876, moneys received for life-memberships were expended. At that time a by-law was enacted which directs that they shall be funded. It is evident that a perennial income of five or six per cent. from a fee of life-membership securely invested is fully equivalent to the semi-annual dues, the payment of which necessarily ceases on the resignation or death of the member. Had the Academy been able to invest all fees for life-membership paid since its origin, a fund would have been accumulated by this time, the income from which would be sufficient to render appeals to members for aid to meet current expenses unnecessary.

There is a hope of pecuniary comfort in the future. It is estimated that at least eight life-memberships will be paid every year, and that the fund arising therefrom will ultimately yield sufficient to relieve the Society from the difficulty of paying its current expenses.

It may be considered expedient at a future time to invest the initiation fees with the life-memberships, and, in this manner, create a curator's fund.

In conclusion, I recommend members not to rely exclusively on the State to supply means to complete the building. The building-fund at this time amounts to $2083. It is believed that, notwithstanding the unpropitious condition of the times, continuous efforts by the members and friends of the Academy to procure individual contributions to the fund will secure its growth until it is sufficient to warrant resumption of the work of construction. Perseverance generally leads to success in every laudable enterprise: let us hope that it may not be wanting or fail in this one.

Respectfully submitted,

W. S. W. RUSCHENBERGER,
President.

REPORT OF RECORDING SECRETARY.

The Recording Secretary respectfully reports that during the year ending Nov. 30, 1877, forty-three members and seventy-one correspondents were elected.

Eighteen members resigned, as follows: C. H. Howell, F. W. J. Wylie, De Forrest Willard, E. K. Tryon, Jr., J. J. Sinnickson, C. P. Sinnickson, T. Sinnickson, Jr., John Thompson, Christian Febiger, G. A. Nicholls, B. A. Lewis, H. H. Smith, James Tyson, B. B. Comegys, J. E. Mears, J. W. Leeds, and W. H. Castle.

The deaths of twelve members and seven correspondents were announced. They have been duly recorded in the published proceedings.

Twenty-nine papers have been presented for publication, as follows: E. Goldsmith 3, Rev. H. C. McCook 2, John A. Ryder 2, D. S. Jordan 2, D. S. Jordan and C. H. Gilbert 1, D. S. Jordan and A. W. Brayton 1, Jacob Ennis 1, Jas. Lewis 1, E. D. Cope 1, T. A. Conrad 1, H. W. Henshaw 1, M. C. Cooke 1, Isaac Burk 1, A. W. Vodges 1, Geo. Hay 1, Wm. F. Bundy 1, Theo. Gill and J. F. Bransford 1, W. H. Dall 1, H. C. Yarrow 1, Burt G. Wilder 1, J. A. Allen 1, Theo. D. Rand 1, John Ford 1, and Wm. G. Mazyck 1. Twenty-eight of these have been printed in the Proceedings, and one remains to be reported on.

One hundred and seventy-six pages of the Proceedings for 1876, and two hundred and eighty pages for 1877 have been issued, the former being illustrated by eleven plain, and the latter by one plain and one colored lithograph.

There were but two meetings during the year at which verbal communications were not made. The speakers were Messrs. Leidy, McCook, Meehan, Koenig, Cope, Blake, Goldsmith, Willcox, Vaux, Frazer, Young, Coates, Martindale, Foote, Hawkins, Chapman, Leconte, Cross, Morris, Redfield, Haldeman, Chatard, Ashburner, Rothrock, Brown, Lawrence Smith, Dougherty, Hunt, Rand, Ford, Chase, Peale, Ennis, McQuillen, Ryder, Thomas, A. H. Smith, Trotter, Reed, Jeanes, Lewis, and others. The more important of these communications have been reported for the Proceedings and published.

Art. VIII., Chapter I., of the By-laws was amended by the ad-

dition of the words, "Provided that no Professor or Assistant Professor in the Academy shall occupy the position of Councillor —those who are ex-officio members of Council excepted."

Twenty-nine complete sets of Mr. Isaac Lea's valuable publications on Conchology and Geology, and about 332 surplus volumes of his "Observations on the Genus Unio," have been presented to the Society by the author. Mr. Charles F. Parker has carefully arranged the loose sheets and plates of which this valuable gift was composed into volumes, and they have been added to the list of publications offered for sale by the Academy.

Dr. J. G. Hunt having resigned from the Council in consequence of his election to the position of Professor of Histology and Microscopic Technology, Mr. S. Fisher Corlies was elected to fill the vacancy on May 29.

All of which is respectfully submitted.

EDWARD J. NOLAN.

REPORT OF CORRESPONDING SECRETARY.

The Corresponding Secretary presents the following report of the business of his office during the past year, ending Nov. 30, 1877.

Letters of transmission from other societies or bodies	56
Letters of acknowledgment	61
Miscellaneous correspondence	21
Acknowledgments from correspondents	20
Letters written by order of the Academy	4
Correspondents notified of their election	77
Acknowledgments for donations to Museum	218

In addition to the above mentioned, numerous letters of a trivial nature have been received and answered, containing inquiries concerning admission to the museum, others offering valueless curiosities for sale at immense prices, and so on. These have not been brought before the Academy for obvious reasons. There have also been received a number of pamphlets and volumes from correspondents, all of which have been placed in the library.

The following letters have been received acknowledging the receipt of Journal and Proceedings.

Jan. 2. Cincinnati Society of Nat. Hist.
Museum of Comp. Zoology, Cambridge, Mass.
American Antiquarian Society, New York.

Jan. 9. Cincinnati Society of Nat. Hist.
Yale College Library.
Jan. 23. Royal University Library, Strasburg.
Poughkeepsie Society of Nat. Hist.
Royal Bavarian Academy, Munich.
Literary and Philosophical Society of Liverpool.
Royal University of Würzburg.
Royal Society of Sciences of Upsal.
Jan. 30. Imperial Botanical Garden, St. Petersburg, Russia.
Heidelburg University.
Feb. 13. California Academy of Sciences.
Feb. 20. Franklin Institute acknowledging loan for Centennial Exhibition.
Mar. 20. Chicago Acad. Sciences.
Mar. 27. American Geographical Society, New York.
University of the State of New York.
Society of Natural History and Medicine, Giessen.
April 3. Natural History Society of Basel.
California Academy of Sciences.
Royal Society of Sciences, Göttingen.
Royal Danish Academy of Sciences, Copenhagen.
April 10. Royal Botanic Garden, Edinburgh.
April 24. Brazilian Legation, New York.
Boston Society of Nat. Hist.
May 22. Smithsonian Institution.
May 29. Royal Grand Ducal Institute of Luxembourg.
Royal Society of London; asking for supply of deficiencies.
May 1. Yale College Library.
June 19. Edinburgh Geological Society.
Royal Society of Edinburgh.
Statistical Society, London.
June 26. Belfast Natural History and Philos. Soc.
July 3. Buffalo Society of Natural Sciences.
Royal Superior Technical Institute of Milan.
July 17. Mus. Comp. Zoology, Cambridge.
July 3. Royal Bohemian Society of Sciences of Prague; asks deficiencies.
July 10. Academy of Natural Sciences, Catania.
July 17. Linnæan Society of Bordeaux; asks deficiencies.
Quarterly Journal of Conchology.
July 24. Royal Norwegian Society of Sciences of Throndhjem.
July 31. Chicago Academy of Sciences.
Aug. 7. Royal Society of New South Wales.
Royal Geological Society of Ireland.
Aug. 14. Museum of Natural History of Carinthia.
Smithsonian Institution, Washington.
Aug. 28. British Museum, London.
South African Museum, Cape Town.

Aug. 28 Yale College Library.
California Academy of Sciences.
Sept. 11. Royal Society of New South Wales; asks exchange.
Oct. 2. Royal Academy, Palermo.
Society for Promotion of Scientific Research, Hamburg.
Oct. 16. Academy of Science and Literature of Montpellier; asks deficiencies.
Natural History Society, Dantzig.
Natural History Society, Frankfurt a. M.
Natural History Society, Augsburg.
Society for Native Natural History, Württemburg.
Oct. 30. New Zealand Institute.
Nov. 13. Royal Society of Edinburgh.
Nov. 27. Worcester Lyceum of Nat. Hist.
Natural History Society of Freiburg.
Academia Regia Lynceorum, Rome.
Royal Society of New South Wales.
Yale College Library.
Museum Teyler, Harlem.

The following letters announce the sending of publications to the Academy.

Jan. 23. Ksl. Leop. Carol. Acad., Dresden; asks for deficiencies.
Board of Direction of the Ferdinandeum at Inspruck.
Royal Bavarian Acad., Munich.
Acad. of Science and Letters of Montpellier, France; asks deficiencies.
Royal Society of Sciences, Upsal.
Manchester Literary and Philos. Society; asks deficiencies.
Jan. 30. Imperial Botanical Garden, St. Petersburg, Russia.
Royal Society of New South Wales, Sydney.
Portuguese Centennial Commission; asks exchange.
Feb. 6. West Riding Geological and Polytechnic Soc., England.
British Museum, London, Eng.
Mar. 6. Department of State, Washington, sending "the Draining of Lake Fucino," accomplished by H. E. Prince Alex. Torlonio, Rome, 1876.
April 3. Linnæan Society of Bordeaux.
Natural History Society of Toulouse, France.
National Society of Agriculture, Nat. Hist., and Useful Arts, Lyons, France; asks deficiencies.
Society of Natural History and Medicine, Geissen.
Royal Academy of Sciences of Vienna.
Natural History Society of Halle.
Natural History Society of Hamburg.
Physico-Medical Society of Erlangen.

April 24. Royal Academy of Sciences, Vienna.
May 1. Academy of Natural Sciences, Catania, sending a memorial diploma, and medal.
British Museum, London, Eng.
May 8. Society for the Encouragement of Horticulture, Berlin.
May 22. Medical Society of Frankfurt a. M.
Belgian Microscopical Society; desires exchanges.
Natural History Society of Leipzig.
Royal Academy of Sciences of Amsterdam.
Catholic University of Louvain; returns a duplicate.
Ksl. Leop. Carol. Acad.; desires deficiencies.
July 3. K. K. Geological Botanical Society of Vienna.
July 10. Ksl. Leop. Carol. Academy of Dresden.
Geological Society of India.
July 17. Society for the Diffusion of a Knowledge of Natural History, Vienna.
July 3. Royal Bohemian Society of Sciences of Prague.
July 24. Royal Norwegian University of Christiania.
Natural History Society of Bamberg.
July 31. Netherland Zoological Society.
British Museum, London.
Aug. 14. Museum of Natural History of Carinthia.
Sept. 11. Royal Society of New South Wales.
Secretary of State of New Hampshire.
Oct. 16. Academy of Science and Literature, Montpellier.
National Museum, Mexico.
California Geological Society sends specimens.
Natural History Society, Dantzig.
Bavarian Academy of Sciences, announcing also the discontinuance of a publication.
Royal Academy, Stockholm.
Royal Hungarian Society, Budapest.
Norwegian Museum.
Natural History Society, Frankfurt a. M.
Royal Zoological Society, Amsterdam.
Society for Native Natural History, Württemburg.
Oct. 23. Dorpat Natural History Society.
K. K. Zoological Botanical Society, Vienna.
Physical Central Observatory, St. Petersburg.
Nov. 27. Batavian Society of Experimental Philosophy, Rotterdam.
Zoological Mineralogical Society, Regensburg.
Medical Society of Frankfurt a. M.
Natural History Society of Toulouse.
Academia Regia Lynceorum, Rome.
Natural History Society, Freiburg.

Miscellaneous Correspondence received:—

Feb. 6. National Institute of France, desiring deficiencies.
Feb. 16. Marshal J. Burdge, Allamuchy, N. J., making general inquiries.
Feb. 27. Emmet Crawford, Lieut. U. S. A., desiring advantages of Museum.
Natural History Club, Vienna, notice of formation.
Zoological Society of Philadelphia, thanks for invitation.
Mar. 6. Dr. Emil Bessels, Washington, concerning Eskimo skulls.
Chas. A. Kesselmyer, concerning Calendarium Perpetuum Mobile.
Mar. 20. J. G. Cooper, M.D., Cal., offering sale of specimens.
Royal Academy of Sciences, Berlin, desiring missing volumes.
May 1. Wisconsin Academy of Sciences, desiring to receive exchanges.
May 15. Royal Botanic Garden of Edinburgh, desiring exchange.
Thos. M. Brewer, of Boston, desires publications for the Museo Civico di Storia Naturali di Genoa.
June 5. Chas. A. B. Hall, Ann Arbor, Mich., regarding Woodruff Expedition.
June 12. Harvey Fisher, Philadelphia, concerning certificate.
Royal University of Strasburg, desiring deficiencies.
July 17. John W. Taylor, Leeds, Eng., desiring certain publications.
July 24. Zoological and Botanical Society of Helsingfors, desiring exchange.
Sept. 13. S. Brusina, Agram, Austria, desiring certain papers.
Prof. Percival de Loriol, Geneva, concerning diploma.
Royal Zool. Soc. Amsterdam, desiring deficiencies.
Nov. 13. Dr. H. Scheffler, Braunschweig, sending publications.
Nov. 27. Publishers of Obst- und Garten-Zeiting, asking exchange in 1878.
Central Meteorological Observatory, Mexico, asking exchange.
Geological Reichsanstalt, Vienna, asking deficiencies.
Prof. Thos. R. Fraser, correcting an error in list of Correspondents.

Letters, acknowledging election as Correspondents, have been received from:—

Prof. Dr. P. Groth, Strasburg, Dec. 17, 1876.
N. S. Maskelyne, London, Dec. 20, 1876.
George Rolleston, Oxford, Eng., Dec. 29, 1876.
Juan J. Marin, Philadelphia, Feb. 7, 1877.
Dom Pedro D'Alcantara, New York, March 20, 1877, by A. P. de Carvalho Borges.
Lieut. A. W. Vodges, Charleston, April 8, 1877.
L. G. de Koninck, Liege, April 23, 1877.
Prof. Alphonse Favre, Geneva, April 23, 1877.
Percival de Loriol, Geneva, April 22, 1877.
Lieut.-General A. Gadolin, St. Petersburg.
H. Trautschold, Moscow.
A. S. Packard, Jr., M.D., Salem, Mass., May 10, 1877.

Valerian von Möller, May 3, 1877.
L. Rütimeyer, Basel, May 12, 1877.
N. de Kokscharow, St. Petersburg, May 19, 1877.
E. Desor, Neuchatel, June 1, 1877.
Baron Ferdinand von Richthofen, Berlin, June 10, 1877.
Dr. F. von Hochstetter, Vienna, June 25, 1877.
Daniel C. Eaton, New Haven, Oct. 26, 1877.
A. M. Owen, M.D., U. S. N., Aug. 22, 1877.
Andrew Murray, London, Oct. 30, 1877.
Dr. Philip de la Harpe, Lausanne, Oct. 31, 1877.
P. Martin Duncan, London, Nov 1, 1877.
Edw. von Mojcisovics, Vienna, Nov. 4, 1877.
John W. Judd, London, Oct. 31, 1877.
J. Gosselet, Lille, Nov. 13, 1877.
J. J. Collenot, Semur, Nov. 3, 1877.
W. Boyd Dawkins, Manchester, Nov. 7, 1877.
Franz Toula, Vienna, Nov. 1, 1877.
William Whitaker, London, Nov. 7, 1877.
Prof. J. G. Rein, Marburg, Oct. 31, 1877.
Dionys Stur, Vienna, Nov. 1, 1877.
J. Bastian, Berlin, Nov. 3, 1877.
Dr. Carl Arendts, Munich, Nov. 12, 1877.
Count August Frederic Marschall, Vienna, Nov. 3, 1877.
Henri Coquand, Marseilles, Nov. 13, 1877.

Respectfully submitted,

GEORGE H. HORN, M.D.,
Corresponding Secretary.

REPORT OF THE LIBRARIAN.

I had the pleasure of announcing in my last annual report that the number of additions to the library for the year ending Nov. 30, 1876, was greater than that of any other year with one exception. The record for the twelve months ending Nov. 30, 1877, shows a still greater increase, the additions during that period numbering 2698, or 207 more than were received in 1876.

Of these accessions 849 were volumes, 1839 pamphlets and parts of periodicals, and 10 maps, charts, photographs, etc.; 2049 were octavos, 540 quartos, 51 duodecimos, and 48 folios.

They were derived from the following sources:—

I. V. Williamson Fund	787	Heirs of the late Dr. Jos. Carson	195
Societies	712	Wilson Fund	79
Editors	439	Rathmell Wilson	67
Authors	216	Connarroe Fund	33

H. C. Coates	23	U. S. Commission of Fish and Fisheries	2
Department of the Interior	22	Messrs. Walch & Son	2
Publishers	9	Dr. Geo. Bennett	1
Portuguese Centennial Commission	9	Jas. L. Claghorn	1
Minister of Public Instruction, Spain	8	The late T. A. Conrad	1
Laurenço Malheiro	7	Corporation of the City of Launcestown	1
Treasury Department	7	Department of Agriculture	1
War Department	7	T. F. Dibbs	1
Minister of Public Works, in France	6	S. A. Forbes	1
Same, through W. S. Vaux	9	Dr. Alfred Fricke	1
Isaac Burk	5	Geological Survey of N. Hampshire	1
F. V. Hayden	5	Geological Survey of Spain	1
Smithsonian Institution	5	Government of Victoria	1
F. B. Hough	4	H. M. Hull	1
Geological Survey of Penna.	4	Chas. S. Keyser	1
Mexican Government	4	Geo. W. Lawrence	1
New South Wales Centennial Commission	4	W. Moore	1
Bureau of Education	3	E. C. Nowell	1
British Museum	2	Messrs. Pawson & Nicholson	1
G. H. Cook	2	The late J. S. Phillips	1
Dr. G. M. Levette	2	A. Randall	1
J. H. Redfield	2	W. C. Stevenson	1
Tasmanian House of Assembly	2	The late Robert Swift	1

They were divided as follows:—

Journals	1575	Mineralogy	19
Geology	207	Physical Science	15
Botany	182	Medicine	13
General Natural History	168	Anthropology	11
Conchology	107	Helminthology	11
Entomology	96	Ichthyology	11
Voyages and Travels	71	Agriculture	10
Bibliography	58	Mammalogy	8
Ornithology	46	Herpetology	6
Chemistry	44	Encyclopædias	3
Anatomy and Physiology	37		

In addition to the prompt arrangement and cataloguing of the accessions, the card catalogue of the works on Voyages and Travels, with copious cross references, has been completed, and more than three-fourths of the books included in the department of General Natural History have been catalogued in the same way. It was hoped that the work in the latter department would be finished, but the entire lack of clerical assistance during the greater part of the year, together with the comparatively short time at my disposal after the performance of the routine duties of the library, has made this impossible. Mr. Thos. P. Parker has affixed numbers to all the books catalogued, with neatness and accuracy.

It will be observed that the I. V. Williamson Fund has furnished the largest number of additions received during the year from any one source. Many of the works so obtained are indispensable to the working naturalist, and but few of them can be referred to in any other library in the city.

A few popular books of travel and general natural history have been obtained by means of the Conarroe Fund arising from the sale of publications given to the Academy by Geo. M. Conarroe, and the income of the Wilson Fund has been devoted as heretofore to the purchase of the continuations of the valuable works subscribed for on behalf of the Academy by the late Dr. Thomas B. Wilson.

Among the special donations during the year, the most important have been the valuable selection from the library of the late Dr. Jos. Carson, presented by his children Hampton L., Ann C., and Susan Carson, and a portion of the library of the late Dr. Thomas B. Wilson, presented by his brother, Mr. Rathmell Wilson. The former included a copy of the Cavendish Society's edition of Gmelin's Handbook of Chemistry, and several other valuable chemical works, together with a large number of volumes on Materia Medica and general botany not before in the possession of the Society. Mr. Wilson's donation was especially important, from the fact that it contained several parts required to complete volumes which had been formerly presented by Dr. Wilson and which remained incomplete at the time of his death.

Sixty-eight letters have been written applying for deficiencies in periodicals, and in addition, propositions to exchange have been sent to the editor of every new scientific journal noted during the year. The answers have been numerous, and for the most part satisfactory; and it is hoped in time to obtain, either by exchange or purchase, complete sets of all journals not at present in the library.

In consequence of the necessity for the strictest economy in the management of the library, as well as all other departments of the Academy, only those books which would be damaged if left unbound have been sent to the binders. These have included the journals most constantly referred to, and a few other volumes received from the publishers in numbers.

A fine portrait in oil of the President of the Academy, Dr. W. S. W. Ruschenberger, was presented by Mr. Wm. P. Jenks, for

which very acceptable gift the thanks of the Society were voted to the donor.

All of which is respectfully submitted.

EDW. J. NOLAN,
Librarian.

REPORT OF THE CURATORS.

The museum of the Academy is in an excellent state of preservation, and in an advanced condition of systematic arrangement. I present a report from Mr. C. F. Parker, the Curator in charge of the museum, of the work done during the year.

PHILADELPHIA, Dec. 8, 1877.

DR. JOS. LEIDY,

Chairman of Board of Curators A. N. S.

DEAR SIR: I herewith inclose the following report of work done in the museum:—

Mr. John A. Ryder has made a catalogue of the mammalia in the museum of the Academy, founded on Dr. Slack's catalogue (Gill's classification being adopted). He has also labelled the crania and osteological collections of bats, rodents, edentates, marsupials, and monotremes, besides the series of crania and horns that are placed around the galleries of the museum.

With the assistance of Mr. Ryder the collection of Ophidia has been undergoing a thorough overhauling, the alcohol has been renewed when necessary, the bottles washed, and new labels written, all old labels being preserved, especially those in the handwriting of distinguished herpetologists who formerly devoted attention to this department of our collection. Seventeen families have been worked over, or about three-fourths of the entire collection. The donations which have been accumulating for some years, have also been distributed in the collection in proper systematic order. Many of these prove to be desiderata to the already large collection.

The collection of Chelonia has also been labelled and arranged during the year; it is found to embrace seven families of sixty-five species, represented by about four hundred and fifty specimens.

The collections illustrating the osteology of the Chelonia, Ophidia, and Sauria have also been labelled.

A considerable number of large labels for the more striking objects in the vertebrate palæontological collections have been prepared and put in place.

The collection of mammal skins has been examined.

The whole collection of birds has been thoroughly examined and dusted, and is generally in good condition.

Mr. W. G. Freedly has finished the arrangement and labelling of the collection of birds' eggs.

The collection of sponges sent to Prof. Hyatt for study has been returned, and has since been labelled and arranged.

The cases in the Museum have all been secured, as far as possible, against dust, by the addition to the doors of strips of list. The greater part of this very necessary work was performed by Mr. Thos. P. Parker.

Most of the specimens given, deposited, and purchased during the year have been labelled, and put in their proper places.

The collection of minerals is being rearranged, and labelled according to the classification of Dana. C. F. PARKER.

Special reports on the additions and improvements to the conchological, botanical, and mineralogical cabinets, will be presented by the sections who have them in their special care.

Additions to the remaining departments of the Academy during the year are as follow:—

Mammals.—Mounted specimens of Phalangista vulpina, and Ornithorhynchus anatus, and skin of Belideus, from Tasmania, presented by W. H. Archer.

Sixteen skins, from Brazil, presented by Dr. José de Saldanha. Reindeer antlers, Cumberland Inlet, from Lieut. W. A. Mintzer. Leather of Kangaroo, Tasmania, from S. Arnett.

Mounted specimen of the Spitz dog. Mrs. John B. Nimex.

Scotophilus cinereus, from J. O. Schimmel; Hesperomys leucopus and Condylura cristata, from Geo. Raphael. Tooth of Sperm whale, from Mrs. Paul Shirley; skull of new-born Donkey, by J. A. Ryder; and a fœtal Calf, by John Winter. Numerous samples of wools, produced in Tasmania, presented by the exhibitors of the International Exhibition of 1876.

Birds—Platycercus cyanopygus, Australia, from the Zoological Society of Philadelphia; Conurus solstitialis, Demerara, from S. S. Haldeman; three mounted Cupidonia cupido and Buteo virginianus, from T. R. Peale; mounted Meleagris gallopavo, crested variety, from J. O. Schimmel; and Speotyto cunicularia, from E. H. Peabody.

Twenty-three species of birds' eggs, from Beesley's Point, N. J., from Caleb Wood; eleven species from another donor; eggs of Crax alector and Callipsittacus novæ-hollandiæ, from G. Pavonarius; Ostrich egg, from Michael C. Carey; specimens from Mrs.

Paul Shirley; and the malformed genitals of a fowl, from P. B. Mingle.

Reptiles, Amphibians, and Fishes.—Four skins of reptiles, Brazil, from Dr. José de Saldanha; a small collection of reptiles, Florida, from Lieut. A. W. Vogdes; Iguana, St. Andrews, from Albert S. Duer; and turtle eggs, Delaware, from G. Freyer. Spelerpes ruber, from W. F. Marshall. Small collection of fishes and reptiles, San Domingo, from W. M. Gabb.

Seventy-seven species of fishes, chiefly from east coast of United States, from the National Museum, through the Smithsonian Institution.

Specimens of the viviparous fish, Zygonectes Notii, Mobile, from Dr. G. H. Masten. An Eel-pout, Zoarces anguillaris, east coast, from G. W. Bugbee & Co.; and a second from Wm. Liming. Two fishes, Bermuda, from P. J. Lauber; Lepidosteus, Delaware Bay, from Mr. Holbrook; Tetrodon laevigatus, N. J., from Dr. Kingston Goddard; and a skeleton of a fish, Chimbote Bay, S. A., from Dr. J. T. Coates.

Articulates.—Seventy-one species of spiders, mostly of Pennsylvania, and a collection illustrating the habits of the American Tarantula, and the architecture, etc., of other spiders, presented, under certain conditions, by Rev. H. C. McCook. Scorpions, Florida, from Lieut. A. W. Vogdes. Cenobita Diogenes, Turk's Island, from Wm. M. Gabb; Limulus polyphemus, Key West, from Dr. G. R. B. Horner; and Menippe mercenaria, east coast, from Wm. Liming. Fulgora lanternera, Brazil, from T. C. Bond; and Gryllotalpa longipennis, from R. W. Merrill. Hornet's nest, from A. T. Goodman; and bark of Hickory mined by Scolytus quadrispinosis, from Dr. E. C. Evans. Cocoons and raw silk, and wax, Peru, from José Carlos Tracy; and Cochineal, reared at Cape Town, from J. McGibbon.

Radiates and Protozoans.—Fourteen sponges, from Florida, in exchange from the Boston Society of Natural History. Corals and hydroids, dredged off Florida, from Lieut. A. W. Vogdes. Coral, Bermuda, from H. A. Slocum.

Fossils.—A human skeleton, together with other bones, teeth, and shells, from a shell-mound at Tampa, Florida, presented by Lieut. A. W. Vogdes.

Eozoon Canadense, from the Laurentian limestone of Canada, from the Geological Survey of Canada through W. C. Stevenson.

Four fossil fishes from the tertiary of Wyoming, presented by Joseph Jeanes.

Fragment of jaw, tooth, and two vertebræ of Mosasaurus; eighteen vertebræ of crocodile; marginal bone of a turtle, and fragments of a fish jaw; and a fossil sponge from the marl and cretaceous limestone of New Jersey, presented by Col. T. M. Bryan.

Ten fossils, mostly Ammonites, from Chili, in exchange from Prof. Domeyko.

Incisor of Kangaroos and Canine of Diprotodon, Queensland, from Dr. Geo. Bennett.

Several molars of Rhinoceros, Colorado, from Dr. Jos. Leidy.

Twenty-eight Upper Silurian fossils, Dudley, England, from T. A. Conrad.

Six Devonian fossils, Richmond, Ind.; a fossil plant, foot track, and rain drop markings, from the triassic shales, Bucks County, Pa., presented by Dr. G. T. Heston.

Shark tooth and a bone, marl of Fostertown, N. J., from H. M. Potts; three reptile bones, N. J., from R. H. Nash; two teeth of Mosasaurus, Lumberton, N. J., from Elwood K. Phillips; and Idonearca, Barnesboro, N. J., from Charles Berry.

Carboniferous fossils, Arkansas, from W. E. Rowell; large coral fossil, Pa., from W. S. Vaux; and Polypodium Hochsteteri and fossil shells, from H. W. Mitchell.

Three samples of Diatomaceous earth, California, from the California State Geological Society.

Two cetacean vertebræ, Ashley R., S. C., from Philip Wineman; and fragment of antler, same locality, from C. S. Bement.

Thirteen species fresh water shells, lignite, and calcaneum of Canis, from bluff on Mississippi, near Alton, Ill.; several fossils from Cuba, and others from East Park, Philadelphia, presented by John Ford.

Two Streptelasma corniculum, near Clifton, England, from Fanning C. Tucker; petrified wood, Launcestown, Tasmania, from A. Harrap; cast of spine of Edestus, Collinsville, Ill., from Dr. G. Hambach; and photograph of skull of Bison latifrons, from Cincinnati Society of Natural History.

Ethnological and Miscellaneous.—The interesting and valuable collection, illustrating the stone age, made by the late Franklin Peale, and bequeathed by him to the American Philosophical

Society, has been deposited in the Academy, on condition of being returned on demand.

A collection of wearing apparel, collected during the years 1838–42 in the Hawaiian, Society, Samoan, and other Pacific Islands, mostly made from bark of the paper mulberry, Broussonetia papyrifera, consisting of the following: 27 tapa dresses, mostly Hawaiian, 4 bed curtains, 3 marros or waist-cloths, 7 mats, Hawaiian and Samoan, 2 pieces of imprinted tapa, 1 oiled bark cloth and a table cover, a number of waist ribbons and imitation shawls, 2 Samoan fishing dresses, made of the leaves of the Dracæna or dragon tree, 2 work-bags, 4 school satchels, 2 poi bowls, an ava bowl used in making the intoxicating drink of the Pacific Islands; a fine specimen of the native New Zealand dress, made of Phormium tenax and dog's hair, Fiji nose flute, pandean pipes from Samoa, a kris from the Sooloo Islands, ancient fly-brush, royal Hawaiian necklace, an apparatus used by the natives to catch fish, stamp used in printing tapa, Hawaiian and Samoan fishing lines, sennit of three kinds, tortoise shell bracelet from Hawii, Tahitian drinking cup made of a cocoanut, Hawaiian quoit and an ancient mirror, gourd containing the perfumed oil with which the Tahitians anoint themselves, dagger from King's Mill Islands, go-go or soap bark from the Phillipines, specimens of the ava root (Piper methisticum), Hawaiian and Samoan necklace, money bag from New Granada, doll dressed in the costume worn by the ladies of Lima about 1840, and various other articles, presented by Titian R. Peale.

Eight specimens of stone implements, from Chester County, Pa., from E. A. Barber.

Native Indian bows and arrows, Central America, from S. S. Haldeman.

A large terra-cotta water filter, presented by Dr. J. M. de Silva Coutinho.

Spurs worn by the "Guasos," of Chili, in 1826, rowel 4 inches in diameter, from Dr. Ruschenberger.

Indian relics, stone muller for grinding pigments, from Joseph Willcox.

Esquimo fishhook from Ivigtut, Greenland, from Lieut. W. A. Mintzer.

Model of Parthenon, Athens; model of pyramid of Cheops, made from the original stone; Japanese pillow and slippers; na-

tive bows and arrows, Sandwich Islands; Malay dirk; clay lamp from Egyptian tomb; brick from the great wall of China, presented by Mrs. Paul Shirley.

Stone implements, consisting of chisels, arrowheads, ornaments, fragments of pottery, etc., from the banks of the Susquehanna near Lewisburg, Union County, Pa., from C. T. Grier.

Pottery, arrowheads from a shell mound at Tampa, Florida, from Lieut. A. W. Vogdes.

One skeleton (adult) one ditto (child), and nine skulls from Peru, presented by Dr. C. A. Siegfried, U. S. N.

Specimen of carved stone pipe from North Western America, from C. S. Bement.

Indian pestle, found on a farm in Bushkill Township, Pike County, Pa., from Maxwell Somerville.

A skull and human bones taken from an Indian mound five miles northwest of Shipman, Ill., Oct. 1875, also shells, pottery, etc. Stone axe from the face of a cutting for a roadway in the outer margin of the Mississippi River, one mile above Alton, Ill. Stone axe from Macoupin County, Ill. Stone axe from near Norristown, Montgomery County, Pa.; six arrowheads from Ohio, three ditto from Illinois, and two from Indiana, presented by John Ford.

Respectfully submitted by

JOSEPH LEIDY,
Chairman of Curators.

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION.

The year just closed has witnessed a marked improvement in the interest manifested in this Section, evinced both in the more liberal display of microscopical objects and the increased number of communications upon allied subjects, which have had the gratifying effect of largely augmenting the attendance upon the meetings. This latter condition has also been contributed to by a modification of the By-laws providing that the meetings of the Section shall be held semi-monthly instead of monthly; while the labors of a business committee, appointed to provide and arrange material for the meetings, have been so efficiently performed that the Section takes pleasure in also recognizing that influence.

Early in the year the Section was called upon to fill vacancies occurring in two of its most important offices, Dr. Ruschenberger having resigned from the directorship, and Dr. Richardson from that of Recorder; the regrets of the Section at this unexpected change was expressed in resolutions of thanks (ordered to be placed on the minutes) to these gentlemen, for the faithful and long-continued discharge of their duties.

Dr. R. S. Kenderdine for Director, and Dr. Carl Seiler for Recorder were elected to fill the vacancies for the unexpired term. Subsequently the Vice-Director and three other members tendered their resignations, all of which were accepted upon the usual conditions. A member was lost in consequence of being dropped from the Academy's list.

This withdrawal of original members has been in numbers more than compensated for by the election of eight active members and the addition of four associates.

A book has been provided by the Curator for the purpose of keeping therein a record of the successful methods of preparing microscopic objects, that the members may have the opportunity of aiding each other in their work.

Six papers have been read before the Section, five of which have been published in periodicals.

Their titles were as follows:—

"Post Centennial Microscopic Notes," by Dr. J. G. Hunt; "Staining and Mounting Animal Tissues," by Dr. Carl Seiler; "Late Improvements in Microscopes," by Mr. Jos. Zentmayer; "Observations upon the Life and Habitat of the Melicerta and Limnias," by Dr. C. N. Peirce; "Eucalyptus Oils," by Thomas Taylor; "Origin and Development of Deciduous and Permanent Teeth," illustrated by sections, and drawings, by Dr. J. H. McQuillen; one lecture on "Some Analogies between Animal and Vegetable Tissues," by Dr. J. G. Hunt; "An Exhibition with the Gas Microscope," by Dr. Reed.

Five verbal communications on "The Reproduction of Plants and especially of the Spyrogara Dubia" were given by Dr. J. G. Hunt; one on a "New Self-Centering Turntable," by Mr. Jos. Zentmayer; one on "Physalia and its Lasso Cells," by Capt. Mortimer; one on a "New Histological Stand," of his invention, by Mr. Jos. Zentmayer; and remarks upon Baush & Lomb's New Microscope, by Dr. J. G. Hunt. These essays and commu-

nications presented as they were with microscopic illustrations, wherever practicable, elicited much interesting and instructive discussion, participated in by many of the members.

On November 19th the annual microscopical exhibition was held, the museum and adjoining rooms being opened and lighted for the reception and better accommodation of our invited guests. At an early hour the members of the Academy never before witnessed so large and interested an audience (numbering near three thousand) as was assembled within its building. Nor did our friends and visitors ever have the pleasure of viewing a more liberal and beautiful display of microscopes and microscopical objects than was on that occasion presented.

Our Director, Dr. Kenderdine, welcomed the audience with some appropriate remarks, in which pertinent allusion was made to the advanced step in education, which had been so largely contributed to by microscopists in urging the importance of educating the eye to observe.

In this necessarily abridged and imperfect sketch of the work and progress of the Section during the past year we see that much yet remains to be done to increase its efficiency and interest; but with what has been accomplished in this department of science, we are warranted in believing that with our present knowledge and growing opportunities we shall recognize the interest awakened as permanent, and that the future will be not less fruitful in results than the past has been.

The officers elected to serve for the ensuing year are as follows:—

Director	Dr. R. S. Kenderdine.
Vice-Director . . .	Dr. J. H. McQuillen.
Recorder	Dr. Carl Seiler.
Corresponding Secretary .	Dr. C. N. Peirce.
Treasurer	Dr. Isaac Norris.
Conservator . . .	Dr. J. G. Hunt.
Curators	Dr. Charles Schaffer, Charles Zentmayer.

C. SEILER,
Recorder.

REPORT OF THE CONCHOLOGICAL SECTION.

The Recorder of the Conchological Section respectfully reports that during 1877 papers have been accepted and published in the Proceedings of the Academy of Natural Sciences, aggregating 106 pages, by authors as follows:—

William H. Dall, 40 pages.	William M. Gabb, 51 pages.
Jas. Lewis, M.D. 11 "	T. A. Conrad, 4 "

During the year the Section has lost by death several of its most useful collaborators. Principal among these was our fellow-member Timothy A. Conrad, who, although not a regular attendant at our meetings, was actively engaged in furnishing papers and illustrations for the American Journal of Conchology from its commencement to its discontinuance. He also contributed to the Academy's Proceedings almost up to the time of his death, and always took great interest in our welfare.

We have also lost two valued correspondents, John G. Anthony, of Cambridge, Mass., and Dr. P. P. Carpenter, of Montreal, Canada.

Mr. Anthony was for many years interested in our fluviatile mollusca. He was a man of liberal ideas, and was ever ready to lend a helping hand to all seeking information, whether the beginner or the more advanced student.

Dr. Carpenter's specialty was the study of the marine mollusks of the West Coast of North America. Both were zealous contributors to our museum, our library, and our publications.

From the report of our Conservator we find that during the year ending Dec. 1st, 1877, 831 species, numbering 2923 specimens have been added to our collection. He says "among the most important of these accessions are:—

"1392 specimens of 355 species of California shells collected by Henry Hemphill, including many rare and minute forms mostly new to our collection, and all from authentic localities.

"243 specimens of 83 species of Polynesian mollusks and shells collected by the Godeffroy expeditions. Most of these are alcoholic specimens, and all are new to the collection. Both the above were purchased from moneys obtained by the sale of dupli-

cates from the collection of the late John S. Phillips, and his name has accordingly been placed on the labels as donor.

"Dr. Isaac Lea has generously given us his entire collection of Unionidæ in alcohol, comprising, in forty large jars, 972 specimens of 234 species. This collection is very valuable from the fact that it includes the types of nearly all the descriptions of the soft parts of Unionidæ described by Dr. Lea.

"The Liverpool Free Public Museum and Library has sent us 50 species, principally of *Oliva* and *Nassa*, including authentic specimens of a considerable number of the species described by Mr. F. P. Marrat, who has made the study of these genera a specialty."

The museum work for the year aggregates as follows:—

New additions	831	trays	and	labels,	2,923 specimens.
Completion of the arrangement of selections from the Phillips collection	449	"	"	1,531	"
The Robert Swift collection has been arranged as far as the end of the marine and fluviatile univalves	2831	"	"	10,883	"
Total	4111	"	"	15,337	"

The Section is again under great obligations to Mr. Charles F. Parker, who has carefully cleansed and mounted for us the whole of the above, principally during hours for which he is not compensated by the Academy as one of its curators. It is the donation to us of the labor of many days. Our collection now contains about 30,000 trays and 100,000 specimens. Your Conservator availed himself, during a visit to Europe the past summer, of an opportunity to institute a comparison between our Conchological cabinet and that of the British Museum in London, and gives the following figures as approximately correct.

The Academy's collection occupies about 2600 square feet in glass cases, and 2000 square feet arranged under glass in drawers, accessible to the public. Total, say 4600 square feet.

The British Museum collection is contained in 48 cases, about 4 x 7 feet each, say 1350 square feet in all. A conchologist familiar with this collection stated that it is principally contained in the glass cases, the exceptions being mostly among the land shells, of which many are in drawers. It would appear from these figures that our collection is at least double in size that

of the British Museum, which has usually been regarded as the largest conchological cabinet in the world.

The officers of the Section for 1878 are—

Director . . .	W. S. W. Ruschenberger.
Vice-Director . .	William M. Gabb.
Recorder . . .	S. Raymond Roberts.
Secretary . . .	Rev. E. R. Beadle.
Treasurer . .	William L. Mactier.
Librarian . . .	Edward J. Nolan.
Conservator . .	George W. Tryon, Jr.

Respectfully submitted,

S. RAYMOND ROBERTS,
Recorder.

The following are the additions to the Conchological Museum received during the year:—

Rev. E. R. Beadle. *Helix intorta*, Sowb., var. *Liguus flammea*, *L. picta*, var. *Tapes aequilatera.*

A fine *Panopæa glycimeris* (dredged alive).

R. I. Betz. *Teredo navalis*, from Atlantic City, N. J.

Thomas Bland. A number of land and marine shells from the Bahamas, including *Helix Milleri*, *H. provisoria*, *Pupa Martensi*, *Cerithium septemstriatum*, *Egeta Floridana*, *Cryptogramma flexuosa*, etc.

Twelve species of *Bulimus*, etc., collected by A. Agassiz in Peru. Thirteen species of *Pupa*, *Realia*, etc., from Mauritius. Nine species fresh-water shells from Mexico.

T. M. Bryan. *Leucocheila marginata*, from Vincenttown, N. J.

W. W. Calkins. Thirteen species of marine shells from Florida and Bahamas.

H. C. Coates. A small collection of shells from the Cape of Good Hope.

W. Doherty. *Pupa Cincinnatiensis*, Judge, from Cincinnati, O. *Somatogyrus aureus*, Tryon, from Kentucky.

John Ford. *Triton Tranquebaricum.* Land and fresh water shells from the Bluff at Alton, Ills.

Wm. M. Gabb. Fifteen species of land and marine shells from St. Domingo. A large number of specimens of eleven species of land and marine shells from Turk's Island.

Mr. Holbrook. Number of specimens of *Mytilus edulis*.

Ernest Ingersoll. *Planorbis plexatus*, Ingersoll, from St. Mary's Lake, Colorado.

Isaac Lea. Forty jars of Unionidæ in alcohol, 257 species.

Joseph Leidy. Remarkable specimen of *Strombus gigas*.

Liverpool Free Public Museum and Library. Fifty species of marine shells. (In exchange.)

E. R. Mayo. Thirteen marine species from the Coast of Massachusetts.

H. W. Mitchell. *Mytilus latus*, Lam., from New Zealand.

Chas. C. Phillips. Eighty-three specimens of twenty-one species of marine and land shells from the Gaboon Coast, Western Africa.

John S. Phillips' Fund. Eleven species from various localities.

A California collection of 355 species, numerous specimens.

Eighty-three species, principally in alcohol, collected by the Godeffroy expeditions in Central Polynesia.

Rutgers College. Four species of marine shells from Japan. (Exchange.)

Mrs. Paul Shirley. Two fine specimens of *Oliva porphyria*.

D. B. Smith. *Cassis tuberosa*, Lam. Young.

A. A. Wright. *Hemifusus elongatus*, Lam., and *Pecten superbus*, Sowb.

REPORT OF THE CONSERVATOR OF ENTOMOLOGICAL SECTION.

The Recorder of the Entomological Section of the Academy takes pleasure in presenting to you a brief abstract of the transactions of the Section during the year just closing.

The Section at the present time numbers twenty-five members; no new members have been elected during the past year.

Nine monthly meetings have been held during the year, at which there has been an average attendance of seven members.

The meetings of the Section are held on the second Friday of each month, excepting in July and December.

Entomological papers intended for publication in the Transactions of the American Entomological Society are read at the meetings of the Section and referred to a publication committee, one

portion of which is elected by the Society and the other portion by the Section.

During the year fifteen entomological papers have been passed upon affirmatively by this committee. Within the same time the committee has superintended the publication of 414 pages and 10 plates, finishing one volume, while another volume will soon be closed.

The library of the Entomological Section has been rearranged and catalogued during the year, and is now open to the common use of the members of the Academy.

The Society during the year has added several valuable works to its library, by purchase and otherwise.

The collections have been greatly improved both in condition and number of specimens. In June last the sum of $125 was voted to the Curators, for the special improvement of the collection of Hymenoptera; and that branch of the collection is at the present time the best in the country.

The collections of Coleoptera and Lepidoptera have been carefully gone over, and all the drawers containing the same thoroughly disinfected. The Curators are now engaged in the work of rearranging these orders, and hope to have the same finished in a short time.

As the great object is to secure, so far as may be possible, the best specimens, and as much matter is constantly accumulating in the hands of the Curators, they will endeavor to cull therefrom all worthless matter and use only such as will enhance the scientific value of the collection.

The cabinets are at all times open to inspection, under the supervision of the Curators.

It is hoped by the close of the coming year the collection will be in such a condition as will make it still further in advance of any similar collection in the United States.

At the meeting held December 10, 1877, the following gentlemen were elected officers for the year 1878:—

Director	John L. LeConte, M.D.
Vice-Director	George H. Horn, M.D.
Recorder	J. H. Ridings.
Treasurer	E. T. Cresson.

Publication Committee . . . E. T. Cresson,
J. L. LeConte, M.D.,
Chas. Wilt,
George H Horn, M.D.,
C. A. Blake.

All of which is respectfully submitted.

J. H. RIDINGS, *Recorder.*

REPORT OF THE BOTANICAL SECTION.

Since the last—our first annual report—our meetings have been held regularly. Seven members of the Academy have been received into the Section during the year, making the total number of members of the Section twenty-nine.

The only paper of general interest submitted to the Section was the List of Ballast Plants made by Mr. Isaac Burk, and which has been published in the Proceedings of the Academy. At every meeting verbal communications of much interest to specialists in various branches of botany have been made by Messrs. W. M. Canby, J. H. Redfield, J. A. Ryder, Thomas Meehan, Isaac Burk, J. C. Martindale, and Prof. Rothrock.

Numerous additions to the herbarium have been made through the Section as per report annexed.

The Conservator's report to the Section is of such general interest that it is submitted herewith entire.

The Treasurer's report shows that all the expenses of the Section have been kept within its income.

The officers elected to serve for the ensuing year are as follows:—

Director	Dr. W. S. W. Ruschenberger.
Vice-Director	Thomas Meehan.
Conservator	J. H. Redfield.
Recorder	Isaac Burk.
Secretary	Dr. J. H. Leffman.
Treasurer	J. O. Schimmel.

Respectfully submitted.

THOMAS MEEHAN,
Vice-Director.

Conservator's Report.—At the date of the last report of the Conservator to the Botanical Section of the Academy, the organization of the Section had but recently been perfected by the appointment of its committees and the allotment of their duties. As was then evident, the work which lay before the Committee on the Academy's herbarium was mainly that of completing its new arrangement, and of providing for ready and convenient access to each species of the large collection therein contained. This work has proved no slight task, but it has been vigorously prosecuted in both departments, viz., that of the General Herbarium and that of the N. American. In the former, tablets have been prepared for the several Natural Orders as far as to the end of the Monopelatous Division of the Exogenous Plants; these tablets showing at a glance the proper position of the order, and the genera referred to it; and, in the larger orders, presenting also an alphabetical index to the synonyms. In both departments, covers of stiff Manilla paper have been prepared and inscribed for the several genera, numbered to correspond with the "Genera Plantarum" of Bentham and Hooker, the latest and best authority for systematic arrangement. It is estimated that above 4000 of these covers have been thus used, and probably 2000 more will be needed to complete the work.

The Conservator and the Herbarium Committee have in this labor received most essential aid from Mr. Charles F. Parker, who, after the hours devoted to his regular duties in the Academy, has given his time to the covering of the tablets, and the inscribing of the genus-covers. Mr. Burk has been constant and industrious in carrying on the arrangement of the N. American Herbarium, while our Vice-Director, Mr. Meehan, has had the more delicate task of deciding difficult points in the determination of species. The sub-committee on duplicates have carried on their work of culling and selection, *pari passu*, with the other labor.

A few months more will complete the general arrangement, and the Conservator and the Herbarium Committee will then be able to turn their attention to the work of cataloguing the collection, of noting its wants, and of establishing correspondence for the purpose of procuring deficiencies. Something has already been done in this direction, and correspondence has been opened with botanists in Brazil, Venezuela, and Syria, which will result, it is believed, in benefit to the Academy.

Although so much has been accomplished during the year by volunteer laborers, who, from love of the science, have given such time as could be spared from other duties, it has become more and more evident that there is before us a vast amount of labor, in the way of careful revision and elaboration of species, and the proper mounting of plants, to which volunteer force is inadequate; and we look forward with hope to the day when the public spirit of our community shall sufficiently endow the Academy to enable it to secure the constant work of a competent botanist, and of an expert mechanical assistant. In no other way can our large collection be properly cared for, or be made to yield its full measure of utility.

Allusion has been made above to our North American Herbarium. Our lamented fellow member, Mr. Durand, spent many years in selecting from the general collection materials for the formation of a special herbarium to illustrate the Flora of N. America. The material for this purpose was ample, and of peculiar value, because it largely consisted of plants collected by Schweinitz, Pursh, Nuttall, Baldwin, Oakes, Torrey, Leconte, and others, many of which were type specimens of the early describers, to which have been added from time to time the later acquisitions made by government and individual explorations in our Western Territories. The convenience and value of such a collection cannot be questioned, and accordingly it has been partially provided for in our upper or working-room, where also is stored the valuable and splendidly mounted herbarium of the late Dr. Short. But to complete its proper arrangement we need an additional case of the same size and style as the two now appropriated to the purpose, and it is hoped that the Academy will find means to provide this needed accommodation.

JOHN H. REDFIELD,
Conservator.

Additions to Botanical Museum and Herbarium, 1877.

Feb. Wm. M. Canby, Wilmington, N. C.; a series of specimens of *Darlingtonia Californica*, Torr., from Northern California, and a specimen of *Canbya candida*, Parry, from San Bernadino Co., California.

P. V. Leroy, Torrey Herbarium, N. Y.; *Primula suffrutescens*, Gray, from Sierra Nevada, California.

Dr. Asa Gray, Cambridge, Mass.; 13 species of exotic plants, and 2 of Californian plants; mostly new to us.

Rev. E. W. Hervey, through J. C. Martindale; *Aster Herveyi*, Gr., from New Bedford, Mass.

March. Dr. C. C. Parry, Davenport, Iowa; polished section of the wood of *Cercocarpus ledifolius*, from S. Utah.

John H. Redfield; polished section of *Bauhinia*, from Brazil, and specimen of *Gymnostomum Brandegei*, a new moss from Colorado.

Thos. Meehan; *Peraphyllum ramosissimum*, Nutt, from Southern Utah; cones of *Pinus palustris*, from Florida.

Isaac Burk; capsule of a large species of *Bignonia;* fruits of *Anacardia orientale*, *Ophiocaryon paradoxum*, and *Gordonia pubescens*, and some other seeds.

April. José Carlos Tracy, Peruvian Commissioner to Centennial Exhibition; 57 species of Peruvian woods.

H. C. Coates, Commissioner from Cape Colony; 54 species of medicinal plants and drugs; 6 species of barks; and samples of vegetable wax from *Myrica cordifolia*, all from South Africa.

Miss Mary B. Rodney, through J. B. Rodney, Germantown, Phila.; "Plantæ Oregonensis," one volume containing 125 species of plants, collected in Oregon by the donor.

Mariano Bárcena, Mexican Commissioner; 47 jars of medicinal plants from Mexico.

Prof. Jos. T. Rothrock, Phila.; 8 species of plants from Arizona, all new to the Herbarium.

May. Prof. W. G. Farlow, Cambridge, Mass; Fungus (*Æcidium pyratum*) on *Pyrus angustifolium.*

Hugh M. Hull, Tasmanian Commissioner; 16 specimens of Tasmanian woods, and 16 samples of Tasmanian seeds, Hobart Town.

Geo. Kemfe; samples of wheat from Upper Bagdad.

C. A. Franklin; Sassafras bark (*Atherosperma*).

Dr. J. Coverdale; gelatinous sea-weed from Port Arthur, and jelly made from the same.

J. W. Graves; native bread (*Mylitta australis*) from Hobart Town.

Mrs. John Thomson; native bread (*Mylitta australis*), Cormiston.

Mrs. Mitchell (through Australian Commission); gum from the Oyster Bay Pine (*Callitris australis*).

Commissioners of Lunatic Asylum, Hobart Town; oil from the Blue Gum Tree, *Eucalyptus globulus*.

Mrs. Paul Shirley; cone of the Cedar of Lebanon.

H. W. Mitchell; leaves of *Phormium tenax*, Forst, with samples of rope, bags, and brushes made from same, Auckland, N. Z.

June. T. R. Peale; *Fucus*, Ocean Grove, N. J.

Sept. Wm. M. Canby, Wilmington, Del.; *Symplocos tinctoria*, L'Her, in fruit, from Sussex Co., Delaware.

John H. Redfield; 15 species of N. American Ferns, mostly new to our N. American Herbarium; also three species of Californian phænogamic plants.

Eugene E. Frank, Wilkesbarre, Pa.; *Botrychium Virginicum*, Fr.

Charles C. Cresson; Rare Fungus (*Cynophallus caninus*, Fr.), Wissahickon woods.

Oct. Department of Agriculture, Washington, D. C.; 420 species of plants, collected in Utah by Second Division of U. S. Geological and Geographical Survey of the Territories, Maj. J. W. Powell in charge; L. F. Ward, collector.

Also 72 species of plants collected in Alaska by W. H. Dall, and 30 species collected in the islands of the Pacific by the same.

C. G. Pringle, Charlotte, Va.; *Gentiana Amarella*, L., *var.* (*acuta* Mx.), from Smuggler's Notch, Mount Mansfield, Vt.

Capt. Robert Wiltbank; fruit of the Ivory-nut Palm (*Phytelephas macrocarpus*), from Cardeck R., coast of San Blas, U. S. of Colombia.

Hampton L., Ann C., and Susan Carson, heirs of the late Dr. Joseph Carson; the botanical collections of Dr. Carson, consisting of dried plants, barks, resins, seeds, etc.

Dec. Dr. Asa Gray, Cambridge, Mass.; 29 species of exotic plants, principally of the order *Sapotaceæ*, and mostly new to our collection; also 35 species of N. American plants, principally from California and Oregon.

REPORT OF THE MINERALOGICAL SECTION.

The Director of the Mineralogical Section of the Academy of Natural Sciences would respectfully report that the Section was organized April 24, 1877, and the following officers elected:—

Director	Theodore D. Rand.
Vice-Director	Wm. H. Dougherty.
Recorder	Henry C. Lewis.
Treasurer	William S. Vaux.
Secretary	Henry C. Lewis.
Conservator	Jos. Willcox.

Meetings have been held every month since that date, except during July and August; the attendance has been good and interest great. The accompanying report of the Conservator shows the work done, which, considering the shortness of the time, must be regarded as highly satisfactory. The appearance of that part of the collection which has been rearranged and relabeled, has been favorably noticed by many members of the Academy.

It is expected that a summary of the scientific work of the Section will be presented to the Academy for publication. The Section numbers nineteen members.

Respectfully submitted,

THEO. D. RAND,
Director.

Report of the Conservator.—Since my election to the office of Conservator, the most important work, under my supervision, has been the rearrangement and classification of the mineral collection of the Academy. On the authority of a resolution of the Section, the arrangement has been made according to the system adopted in the last edition of Prof. Dana's Mineralogy. This operation has been completed, and already some progress has been made in relabeling the specimens upon cards of uniform style; and it is expected that this work will be fully performed during the winter. It is proposed to put the specimens in paper trays of suitable size; and it has been ascertained that under this plan the

minerals will not occupy a greater space than under the existing arrangement, while the attractiveness of the collection will be greatly increased.

The additions to the collection of minerals during the past year have been as great as usual, and satisfactory. Appended is a list of the donations.

Mr. H. C. Lewis has completed the optical examination of the micas in the collection of the Academy, and the divergence of the optic axes thus determined will be appended to the new labels. Much credit is due to Mr. Charles F. Parker for his industry and care in rearranging the mineral collection.

JOSEPH WILLCOX,
Conservator.

Additions to Mineralogical Cabinet.—E. R. Beadle, in exchange. Two specimens of Pyroxene, 1 Scapolite, Slate Nodules, and 2 Hornblendes, 1 Black Tourmaline, 1 Tremolite, 1 Albite (Peristerite), 1 Stilbite, 1 Kieserite, 1 Hæmatite, 1 Magnesite, 2 massive Apatites (Osteolite), 1 Titaniferous Iron, Apatite, Feldspar, etc., from various localites; Fibrous Gypsums, and Elaterite (Elastic Bitumen) from Derbyshire, England.

C. S. Bement. Twenty-five specimens of minerals from various localities, consisting of Corundum, Menaccanite, Perofskite, Gahnite, Franklinite, and Willemite, Rutile, Göethite, Limonite, Chalcophanite, Garnet, Scapolite, Tourmaline, Brewsterite, and Strontianite, Apatite, Apatite in Calcite, Apatite with so-called fused Quartz and Pyroxene, Vanadinite, Pyrrhotite, with Chalybite, and Mesitite, and Cerussite, etc.

Prof. W. P. Blake, on behalf of the National Museum. Specimen of flexible Sandstone (Itacolumite), from Stokes Co., N. C.

E. M. Bye. Slab of polished Serpentine, Harford Co., Md.

Dr. J. T. Coates. Volcanic Rock, from the crater of "Misti," Arequipa Volcano, from 18,600 feet elevation, Peru.

H. C. Coates, Cape of Good Hope Commission. A number of specimens of ores of copper, Galena, Manganese, Coal, etc., Cape of Good Hope.

Lieut. E. Crawford. A small collection of rock specimens from the Black Hills, Wyoming Territory.

Prof. Domeyko, on behalf of the Chilian Centennial Commission, in exchange. Mineral specimens consisting of Chrysocolla Erythrite, Atacamite, Malachite, Coquimbite, Proustite, Chal-

cophillite, Cerargyrite, Arquerite, Fibroferrite, Argentiferous Tetrahedrite; Oxide, Sulphides, and Silicate of Copper. A large number of specimens of minerals, ores, and rocks, including fine examples of Quartz Crystals, Copper, and Silver ores, Cobalt, Sulphur, Galena, Tremolite, Hornblende, Cinnabar, Azurite, Hayesine, Prowstite in Limestone, Aragonite, Salt, Native Arsenic, Philippite, Kronkite, Nitrate of Soda, Effloresence from the Laguna of Maricunga, and fifty rock specimens. All from Chili, Peru, and Bolivia.

W. H. Dougherty. Native copper in the Hecla and Calumet Conglomerate, Houghton Co., Mich.; Chalcopyrite, Christiania, Norway.

W. D. Eyre. Asbestos with fibres 3¾ ft. long, Val Tellina, Piedmont.

John Ford. Two specimens of Peacock Anthracite, Schuylkill Co., Pa.

E. Goldsmith. Specimens of Triassic Coal, Montgomery Co., Pa.

H. A. Green. Aragonite and Calcite in Geode, Warsaw, Illinois.

Julian Gutierrez, through M. Bárcena. Slab of Travertine Limestone (Mexican Onyx), from the Tecali Quarries, Puebla, Mexico.

J. Hazard. Specimen of Drusy Quartz, from Mine La Motte, Mo.

J. Heistand. Two Stalactites, Middletown, Dauphin Co., Pa.

Russell Hill. Dolomite Actinolite, Magnetic Iron and Pyrites, Garnets in Mica Schist, from the Soapstone Quarry, Manayunk, Phila.

Jos. Jeanes. Two specimens of Amethyst, two of Quartz on Chalcedomy, three of Chalcedomy, one of Tufa, and specimens of Sulphur, all from the National Park, Montana.

W. W. Jeffries, in exchange. Kyanite, Margarite on Corundum, Aquacreptite, Amazon Stone, Lennilite, Hallite, Chesterlite, and Chromite in Serpentine, from Chester and Delaware Counties, Pa.; Asbestos, Phlogopite, Sandstone, Feldspar, from various localities of Arberton; Tourmaline, Kammererite, Fibrolite, Magnesite, Actinolite, Kyanite, and Quartz.

Dr. Linn. Specimen of Apatite, Schischimsk, Siberia.

H. C. Lewis. Ripple marks in Medina Sandstone (No. 4), Blackleg Gap, Huntingdon Co., Pa., and Siderite, Dunbar, Fayette Co., Pa.; Biotite, Darby Creek, Darby, Phila.; Lepidomelane, Frankford, Phila.

Dr. Jos. Leidy. Spinel in Chlorite, from Franklin, Macon Co., N. C. Light Brown Tourmaline, St. Lawrence Co., N. Y. Green Tourmaline in granite, Paris, Me. Two terminated Crystals of Topaz, from Minas-Gereas, Brazil. Two Crystals of Green Tourmaline; two terminated Crystals of the same; one terminated Crystal of Black Tourmaline; one Crystal of Tourmaline (Indicolite); one Crystal of Rubellite; one section of Crystal of Rubellite and Green Tourmaline, all from Villa Rica, Brazil. Red and Green Tourmaline, with Cookeite, in quartz, from Mt. Mica, Paris, Maine. Kyanite, from Delaware Co., Pa. Crystalline Slag, from Swedes' Furnace, Upper Merion, Montgomery Co., Pa. Laumontite, from east side of the Schuylkill, Philadelphia Park. Crystalline Slag from copper furnace, Baltimore, Md. Rock Milk, from Hot Springs, Gardner's River, National Park. Mica, Pennsbury, Chester Co., Albite, with Muscovite, near Media, Delaware Co., Muscovite, with Biotite, Laurel Hill, Phila. Sulphuret of Cadmium on Blende, from Friedensville, Lehigh Co., Pa. Jadeite and Talcose schist, from Easton, Pa. Calcite, from Martinsburg, Lewis Co., N. Y. Pyroxene and Feldspar, from Rossie, N. Y. Scapolite and Peristerite, from Pierrepont, N. Y.

From the same, in exchange. Hydrodolomite on Chromite, from Texas, Lancaster Co., Pa. Opal, from near the south fork of the American River, California.

H. W. Mitchell. Twenty-two Minerals and Rocks from Auckland, New Zealand.

W. A. Mintzer, U. S. N. Four large, black Tourmalines, 15 inches long. Four additional terminated Crystals, from 1 to 7 inches long, Harbor of Niantilik, Cumberland Gulf, north lat. 64° 56′, W. long. 66° 21′.

Galloway C. Morris. One specimen of Coorongite; three of Mineral Caoutchouc, from Southern Australia.

Mr. Julius Partz. Marecanite, near Benton, Mono Co., Cal. Acicular Obsidian. Three specimens of Partzite, one Blende, and one other mineral.

Chas. C. Phillips. Two specimens of Copalite, from Zanzibar, Africa; two of Asphaltum, Cuba.

Theo. D. Rand. Five Molybdenites, and a specimen of Stilbite from Frankford, Phila. Aragonite in Chlorite, and Millerite

in Dolomite, Soapstone Quarry, Phila. Muscovite and Orthoclase, west of Fairmount Dam, Phila. A very fine collection of Rocks from the vicinity of Philadelphia, numbering 131 specimens. Molybdic Ochre, Upland, Delaware Co., Pa.; Metaxite, Lancaster Co., Pa. One specimen of Meerschaum; two Chalcedony; one Blue Apatite; one Quartz, Pseudomorph after Calcite; one Oct. Cryst. of Zinc Blende in Cryolite; one Carbonate of Iron in Cryolite, from Greenland. Also 114 specimens of minerals from the neighborhood of Philadelphia.

S. R. Roberts. Four samples of Coal Oil from Franklin, Pa.

W. E. Rowell. A small collection of minerals and rocks from Arkansas.

Samuel L. Smedley. Two specimens of Clay dredged from middle of Schuylkill at Penrose Ferry bridge at a depth of 30 to 36 feet below low water mark.

Adolph Lutro, through W. H. Dougherty. One hundred and seventy-seven specimens of the rocks traversed by the "Sutro tunnel" towards the Comstock silver lode at Virginia City, Nevada.

J. F. Tottenham, through A. D. Jessup. Twenty-two specimens of Beckite, from Devonshire, England.

José Carlos Tracy, of the Peruvian Commission. Two hundred and seventy-seven minerals, handsomely arranged in sixteen cases, from Peru.

Jos. H. Tull. Specimens of Sulphuret of Silver (Argentite). Ruby Silver (Proustite), from the New York Cañon, Lander Co., Nevada. Coke from accidental combinations of Lignite, Cottonwood Cañon, Humboldt Valley, Nevada.

W. S. Vaux. Two large Crystals of Scapolite, from St. Lawrence Co., N. Y.

Victoria Centennial Commission, through Sir Redmond Barry. A large mass of Garnierite from New Caledonia, Australia; also specimens of Lignite, Chalcopyrite, Bituminous Coal, and forty-six rock specimens from Victoria, Australia.

Dr. Jas. White. Garnets, Ceylon.

Jos. Wilcox. Tremolite, Quartz, Garnet, Feldspar, Crystals of Serpentine and Zircon from different localities. Tremolite from St. Lawrence Co., New York, and Blue Carbonate of Lime from Calumet Island, Canada. Large Sphene, N. Y.

Fine Crystals of Feldspar from Pike's Peak, Colorado. Thirteen minerals, including Feldspar, Muscovite, Actinolite, Staurotide, Corundum, Corundum with Ripidolite; Corundum, Margarite, and Tourmaline from various localities. Chlorite Pseudomorph after Magnetite from Spurr Mine, Michigan. Tourmaline, Alexander Co., N. C.

The following Tasmanian minerals were presented through H. P. Welch, Centennial Commissioner for Tasmania, on behalf of their respective donors :—

British and Tasmanian Charcoal Iron Co. Iron Ores, Pig Iron, etc.

Dr. J. Coverdale. Red Ochre, earth for paints, pipe clay, from Port Arthur.

F. Groom. Coal from Fingal. Harefield.

W. Hammond. Bismuth from Mount Ramsey, Hobart Town.

Jas. Harcourt. Iron Ore, Pig Iron, and Coal from Seymour.

Hæmatite Iron Works. Iron Ores, Blue and White Limestone, West Tamar.

H. J. Hull. Tin Ore, George's Bay, Hobart Town.

J. Hurst. Coal from Tasman's Peninsula.

J. H. Innis. Tin Ore from Ringarooma and George's Bay, Hobart Town.

T. C. Just. Magnetic Iron Ore, etc., Launceton.

W. A. Kermode. Salt, from Salt Pan Plains. Two blocks of Freestone, Mona Vale.

Jas. Laughton. Umber and Sienna Clay from Hobart Town.

Lyell & Gowen. Slate, Tin Ore, Marble, Limestone, and Coal, Melbourne.

E. Raynor. Limestone, with Fossils, Bridgewater.

Dr. Smart. Gold in quartz, Hobart Mine, Fingal, Hobart Town, Stanhope County. Tin Ore.

R. Strachan. Salt, from Salt Works, Cambridge.

The following purchases were made: Jasper, Vergennes, Vt.; Datolite; Analcite, Phœnix, Mich.; Amethyst, L. Superior; Millerite in Dolomite, St. Louis, Mo. Amazon Stone (Orthoclase), from near Pike's Peak, Colorado. Curved Crystals of Calcite, Amethysts, and Agate, from the Yellowstone Park, N. W. Wyoming.

The election of Officers for 1878 was held in accordance with the By-laws, with the following result:—

President . . .	W. S. W. Ruschenberger, M.D.
Vice-Presidents . .	Wm. S. Vaux, Thomas Meehan.
Recording Secretary .	Edward J. Nolan, M.D.
Corresponding Secretary	George H. Horn, M.D.
Treasurer . . .	Wm. C. Henszey.
Librarian . . .	Edward J. Nolan, M.D.
Curators . . .	Joseph Leidy, M.D., Wm. S. Vaux, Chas. F. Parker, R. S. Kenderdine, M. D.
Councillors to serve three years	Geo. A. Koenig, Ph. D., J. H. McQuillen, M.D., Chas. P. Perot, Geo. Y. Shoemaker.
Finance Committee .	Aubrey H. Smith, Robert Bridges, M.D. Edward S. Whelen.

ELECTIONS DURING 1877

MEMBERS.

January 30.—C. W. Cross, J. T. Montgomery, Jos. M. Stoddart, H. Ernest Goodman, M.D., Thos. Biddle, Jr., M.D., Wm. G. Audenried, Jos. Thomas, M.D., I. S. Moyer, M.D., and Clarence C. De Lannoy.

February 27.—Frank L. Scribner and Mrs. Mary Wagner.

March 27.—Charles Ashburner and Thomas Mackellar

April 24.—Jos. G. Rosengarten, Edgar F. Smith, Ph.D., J. Marshall Stoddart, Jr., and Gertrude K. Peirce.

May 29.—Andrew C. Craig, William John Potts, John E. Cook, Charles Zentmayer, Samuel L. Fox, Shippen Wallace, and Joseph D. Schoales, M.D.

June 26.—Rev. Chas. F. Thomas.

July 31.—Julia A. H. Walker.

August 28.—B. F. Lautenbach, M.D., and Frank Woodbury, M.D.

September 25.—A. J. Drexel, Alexis S. Cope, Miss Clementine Cope, and Miss C. E. Cope.

October 30.—C. Few Seiss, Miss E. B. Rice, Miss Mary B. Rice, Andrew J. Parker, M.D., J. D. Thomas, M.D., and S. H. Guilford, M.D.

November 27.—A. H. Franciscus, Henry Pemberton, Jr., Henry Cope Haines, Oswald J. Heinrich, and Wm. R. Wharton.

CORRESPONDENTS.

January 30.—J. M. Da Silva Coutinho, M.D., of Rio Janeiro; Wm. A. Mintzer, M.D., U. S. N.; L. Nicholsky, of St. Petersburg; Gen. A. Gadolin, of St. Petersburg; Nikolai V. Kokscharow, of St. Petersburg, and L. de Koninck, of Bruxelles.

February 27.—Alphonse Favre, of Geneva; Percival De Loriol, of Geneva; Baron Ferdinand Freiherr Von Richthofen, of Berlin; Dr. Fred. Von Hochstetter, of Vienna; Edouard Desor, of Neuchatel; Ludwig Rütimeyer, of Basel; Valerien De Moeller, of St. Petersburg; H. Trautschold, of Moscow; and Lieut. A. W. Vogdes, U. S. A.

March 27.—P. A. Von Kotschubey, of St. Petersburg.

August 28.—Wm. A. Buckhout, of Centre County, Pa.

September 25.—Clarence King, of Washington; Daniel C. Eaton, of New Haven; Count A. G. Marschall, of Vienna; Edward Von Mojsisovics, of Vienna; Dionys Stur, of Vienna; Franz Toula, of Vienna; A. Bastian, of Vienna; J. G. Rein, of Frankfurt on the Main; C. Arendts, of Munich; Spiridione Brusina, of Agram; Jos. Szabo, of Buda Pest; C. Stahl, of Stockholm; Philippe de la Harpe, of Lausanne; Elisée F. Reclus, of Paris; Emile Cartailhac, of Toulouse; Ernest Chantre, of Lyon; J. J. Collenot, of Semur; Henri Coquand, of Marseilles; Jules Gosselet, of Lille; Edmund Hébert, of Paris; Wm. Boyd Dawkins, of Manchester; Peter Martin Duncan, of London; A. H. Green, of Leeds; J. W. Judd, of London; John Morris, of London; Andrew Murray, of

London; Wm. Whitaker, of London; and H. B. Medlicott, of Calcutta.

October 30.—Sereno E. Watson, of Cambridge; Wm. G. Farlow, of Cambridge; Geo. L. Goodale, of Cambridge; John Duns, of Edinburgh; Dr. Ernst Candeze, of Liege; Dr. C. A. Dohrn, of Stettin; Baron E. Von Harold, of Berlin; Vicomte Henri de Bonvouloir, of Paris; Baron Maximilien de Chaudoir, of St. Petersburg; Henry W. Bates, of London; Etienne Mulsant, of Lyons; M. A. Chevrolat, of Paris; S. Solsky, of St. Petersburg; Alfred Preudhomme de Borre, of Bruxelles; Jules Putzeys, of Bruxelles; Chas. C. Parry, of Davenport, Iowa; A. Ernst, of Venezuela; G. V. Black, of Jacksonville, Ill; R. J. Lechmere Guppy, of Port of Spain, Trinidad; and Edw. Hull, of Dublin.

November 27.—H. Halloway, M.D., of Laporte, Ind.; Dr. Robt. Wiedersheim, of Freiburg i B.; Carl Semper, of Würzburg; Chas. Brongniart, of Paris; George Bowdler Buckton, of Weycombe, Haslemere, England; and Geo. W. Lawrence, M.D., of Hot Springs, Arkansas

ADDITIONS TO THE LIBRARY, 1877.

Adams, A. L. Notes of a Naturalist in the Nile Valley and Malta.
Field and Forest Rambles. I. V. Williamson Fund.
Observations on the Remains of the Mammoth and other Mammals from Northern Spain.
On a Fossil Saurian Vertebra (Arctosaurus Osborni) from the Arctic Regions.
On Gigantic Land Tortoises.
Monograph of the British Fossil Elephants. Part I. The Author.

Albertis, L. M. D'. Journal of the Expedition for the Exploration of the Fly River. Dr. Geo. Bennett.

Allen, J. A. The Influence of Physical Culture in the Genesis of Species. The Author.

Armstrong, J., John Young, and David Robertson. Catalogue of the Western Scottish Fossils. I. V. Williamson Fund.

Ashburner, C. A. Measured Section of the Palæozoic Formations in Middle Pennsylvania. The Author.

Ashhurst, J. Transactions of the International Medical Congress, 1876. The Editor.

Baillon, M. H. Dictionnaire de Botanique. Nos. 1–6. I. V. Williamson Fund.
Natural History of Plants. Vols. 2, 3, 4. I. V. Williamson Fund.

Baily, W. H. Figure of Characteristic British Fossils. Parts III. and IV. I. V. Williamson Fund.

Barber, E. A. Aboriginal Funeral Customs in the United States. By E. A. Barber. The Author.
Comparative Vocabulary of Utah Dialects. The Author.

Bárcena, M. Noticia Cientifica de una parte del Estado de Hidalgo. The Author.

Barker, J. N. Botanical Journal.

Barkow, H. C. L. Comparative Morphologie des Menschen und der Menschenähnlichen Thiere. 1er Th. I. V. Williamson Fund.

Barton, W. P. C. Compendium of Medical Botany.
Flora of North America.
Essays on Materia Medica.
Elements of Botany. Heirs of Dr. Jos. Carson.

Bartsch, S. Rotularia Hungariæ. Hungarian Academy of Sciences.

Bary, A. de. Ueber die Fruchtentwickelung der Ascomyceten. Rathmell Wilson.

Beck's Botany. Heirs of Dr. Jos. Carson.

Bellardi, L. I Molluschi dei terreni terziari del Piemonte e della Liguria. Parte I. and II. I. V. Williamson Fund.

Belt, T. The Drift of Cornwall and Devon.
On the Loess of the Rhine and the Danube.
Geological Age of the Deposits containing Flint Implements at Hoxne. The Author.
The Steppes of Siberia. The Author.
The Glacial Period in the Southern Hemisphere. The Author.

Benecke, E. W. Geognostisch-paläontologische Beiträge. 2er Bd, 3 Heft.

Benoit's Testacei Estramarini della Sicilia ulteriore. Quad. I. Rathmell Wilson.
Bentham and Hooker's Genera of Plants. Vols. I. and II. Conarroe Fund.
Berendt's Organische Reste im Bernstein. Rathmell Wilson.
Bergen's Museum. Samlingen af Norske Oldsager. Katalog over Dyrsamlingen. The Museum
Bertkau, P. Bericht über die Wissenschaftlichen Leistungen im Gebiete der Entomologie, 1871–72. Wilson Fund.
Besler, B. Hortus Eystettensis, 1613. Deposited by Messrs. Pawson and Nicholson.
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Bigelow's Plants of Boston. Heirs of Dr. Jos. Carson.
Medical Botany. Heirs of Dr. Jos. Carson.
Binney, W. G. Nineteen Conchological Pamphlets. The Author.
Bischoff's Chemical and Physical Geology. Heirs of Dr. Jos. Carson.
Bischoff, T. L. W. Historisch-kritische Bemerkungen zu den neuesten Mittheilungen über die erste Entwickelung der Saugethiereier. I. V. Williamson Fund.
Blanchard, E. Les Insectes. Livrs 5–45. Wilson Fund.
Un Naturaliste du Dix-Neuvième Siecle, Louis Agassiz. The Author.
Bland, T., and W. G. Binney. On the Systematic Arrangement of the North American Mollusks. T. Bland.
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Bleeker, P. Atlas Ichthyologique des Indés Orientales Néerlandaises. Livrs. 31–33. Wilson Fund.
Same. Livr. 21. Rathmell Wilson.
Blytt, Axel. Norges Flora. 3e Dl. Royal Norwegian Society of Sciences.
Bohnenseig, G. C. W. and W. Burck. Repertorium Annuum Literaturæ Botanicæ Periodicæ. S. II. and III. I. V. Wiliamson Fund.
Bois-Reymond, Edw. Gesammelte Abhandlungen zur allgemeinen Muskel- und Nervenphysik. 2er. Bd. I. V. Williamson Fund.
Boissier, E. Flora Orientales. Vols. I.–IV., Fasc. I. I. V. Williamson Fund.
Bolton, H. C. Application of Organic Acids to the Examination of Minerals. The Author.
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Bourguignot's Malacologie de l'Algerie. 6me. Fasc. Rathmell Wilson.
Brehm's Thierleben. 1 Bd 1 to 12 Heft; 2 Bd. 1–11 Heft; 3 Bd. 1–4 Heft; 9er Bd. 1–13 Heft. I. V. Williamson Fund.
Brereton's Flora Columbiana. Heirs of Dr. Jos. Carson.
Brightwell, Miss. Life of Linnæus. Rathmell Wilson.
British Museum Catalogues. List of the Specimens of Birds. Part II., Section 3 and 4; Part V.
List of the Mollusca. Part II.
Carnivorous Mammalia.
Ruminants (Pecora).
Handlist of Edentate Mammals.
Catalogue of Seals, and Supplement.
Handlist of Seals.
Catalogue of Monkeys.
Catalogue of Bones of Mammals.
Catalogue of Shield Reptiles, Supplement 1, Appendix, and Part II.
Handlist of Shield Reptiles.

Catalogue of Amphipodous Crustacea.
Catalogue of Sea Pens.
Catalogue of Lithophytes.
Catalogue of Marine Polyzoa. Part II.
Catalogue of British Birds.
Catalogue of Non-parasitic Worms. I. V. Williamson Fund.
Catalogue of Birds. Vol. 3. The Trustees.
Catalogue of British Hymenoptera, 2d ed. Part I. The Trustees.
Brogger, W. C. Bidrag til Kristianiafjordens Molluskfauna. I. V. Williamson Fund.
Brone-Volber, A. J. Aphorismes de Medicine Positive. The Author.
Brown, H. G. Klassen und Ordnungen des Thier-Reichs. 5er Bd. 21–24 Lief.; 6er Bd.; I. Abth. 2 Lief.; II. Abth. 14–17 Lief; V. Abth. 13 and 14 Lief. Wilson Fund.
Brown, J. C. Forests and Moisture. Conarroe Fund.
Brown, C. B. Cave and Camp Life in British Guiana. I. V. Williamson Fund.
Bruch, C. Vergleichende Osteologie des Rheinlachses.
Brühl, C. B. Zootomie aller Thierklassen. Lief. 6, 7. I. V. Williamson Fund.
Brusina, S. Ipsa Chiereghini Conchylia. I. V. Williamson Fund.
Buch, L. von. Gesammelte Schriften. 3er Bd. I. V. Williamson Fund.
Buckton, G. B. Monograph of the British Aphides. Vol. I. I. V. Williamson Fund.
Bulletin Météorologique Mensuel de l'Observatoire de l'Université d'Upsal. VII. The University.
Bureau of Statistics. Quarterly Report, Nos. 1, 2. Treasury Department.
Bushman, An Old. Spring and Summer in Lapland. Conarroe Fund.
Butler, A. G. Illustrations of Typical Specimens of Lepidoptera Heterocera in the collection of the British Museum. The Trustees of the Museum.
Cameron, V. L. Across Africa. Conarroe Fund.
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Canefri, C. T. Studio Monografico Sopra i Muricidi del Mar Rosso. I. V. Williamson Fund.
Zoologia del Viaggio Intorno al Globo, 1865–68.
Malacologia. I. V. Williamson Fund.
Capel, C. C. Trout Culture. I. V. Williamson Fund.
Capellini, G. L'Uomo Pliocenico in Toscana.
Sui Terreni terziari die una parte del versanti settentrionale dell Apennino.
Sui Cetoterii Bolognesi. The Author.
Carpenter, P. P., Memoir of. 2d ed. The Author.
Carpenter, W. P. The Microscope and its Revelations. I. V. Williamson Fund.
Principles of Mental Physiology. I. V. Williamson Fund.
Carrington, B. British Hepaticæ. Parts I.–IV. I. V. Williamson Fund.
Carus' Icones Zootomicæ. 1e Hefte. Rathmell Wilson.
Cassell's Popular Natural History. Vols. 1–4. I. V. Williamson Fund.
Cassin, J. Birds of California. No. 1. Rathmell Wilson.
Catalogue of the Books in the South African Library. H. C. Coates.
Cazzuola, F. Dizionario di Botanico. The Author.
Centennial Exhibition, Portuguese Department. Five Catalogues. Portuguese Commission.
Chaillé, C. Central Africa. Conarroe Fund.

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Chaudé, l'Abbé. Botanique Descriptive. I. V. Williamson Fund.
Chaumeton. Porret and Chamberet's Flore Medicale. Heirs of Dr. Jos. Carson.
Chief of the Bureau of Statistics. Quarterly Report, No. 4. The Treasury Department.
Chief of Engineers. Annual Report, 1876, Parts I., II., III. War Department.
Chief Engineer of Water Department, Philadelphia. Annual Report, 1876. Wm. H. McFadden.
Claparede, E. Recherches sur l'Evolution des Araignées. Rathmell Wilson.
Clapp's Synopsis of the Medicinal Plants of the United States. Heirs of Dr. Jos. Carson.
Clarke, W. B. Mines and Mineral Statistics of New South Wales. N. S. W. Centennial Commission.
Claus, C. Traite de Zoologie. Fasc. 7. I. V. Williamson Fund.
Untersuchungen zur Erforschung der Geneologischen Grundlage des Crustaceen-Systems. I. V. Williamson Fund.
Claus, C., and G. Moquin-Tandon. Traité de Zoologie, Fasc. 6. I. V. Williamson Fund.
Clément, C. Catalogue des Mollusques Marins du Gard. I. V. Williamson Fund.
Coates, I. T. Centennial Fourth of July Oration delivered at Chester, Pa. The Author.
Cohn, F. Beitrage zur Biologie der Pflanzen. 1–3 Heft, and 2er Bd. 1 and 2 Heft. I. V. Williamson Fund.
Kryptogamen-Flora von Schlesien. 1er Bd. I. V. Williamson Fund.
Colorado, Drainage Map of. Department of the Interior.
Commissioner of Education. Report, 1875. Bureau of Education.
Commissioner of Indian Affairs. Annual Report, 1876. Department of the Interior.
Commissao Geologica de Portugal. Estudos Geologicos, 1866–67. Laurenço Malheiro.
Commissao Central Permanent de Geographia Annaes, No. 1. The Commission.
Cook, G. H. Annual Report of the State Geologist of New Jersey, 1872 and 1876. The Author.
Cooke, M. C. Manual of Structural Botany. I. V. Williamson Fund.
A Plain and Easy Account of the British Fungi.
Mycographia seu Icones Fungorum. Parts I., II., III. The Author.
Contributions to Mycologia Britannica. The Myxomycetes of Great Britain. The Author.
Cope, E. D. Paleontological Bulletin, Nos. 24–26.
Partial Synopsis of the Fresh-water Fishes of North Carolina. The Author.
U. S. Geographical Survey west of the 100th Meridian. Part II., Vol. 4—Paleontology. The Author.
Tenth Contribution to the Herpetology of Tropical America. The Author.
On the Brain of Coryphodon. The Author.
On the Brain of Procamelus Occidentalis. The Author.
On some Extinct Reptiles and Batrachians from the Judith River and Fox Hills Beds of Montana. The Author.

Report on the Geology of the region of the Judith River, Montana, and on Vertebrate Fossils obtained on or near the Missouri River. The Author.

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Batrachia and Reptilia of Costa Rica. The Author.

Cordeaux, J. Birds of the Humber District. I. V. Williamson Fund.

Cordier, F. S. Les Champignons. 4me ed. I. V. Williamson Fund.

Coues, E., and J. A. Allen. Monographs of North American Rodentia. Department of the Interior.

Coultas' Principles of Botany, Phanerogamia and Cryptogamia. The Plant. Heirs of Dr. Jos. Carson.

Cresson, E. T. Report upon the Collections of Hymenoptera made in Nevada, Utah, etc., during 1872, '73, '74. The Author.

Notes on the Species belonging to the sub-family Ichneumonides found in America north of Mexico. The Author.

Cressy, N. Second, Third, and Fourth Annual Reports on the Diseases of Domestic Animals in Connecticut. The Author.

Crow, H. Zoophilos. Rathmell Wilson.

Cura Completa para Caballos. Portuguese Centennial Commission.

Cuvier, Baron. The Animal Kingdom, with additions by W. B. Carpenter and J. O. Westwood. I. V. Williamson Fund.

Cuvier, G., and Laurillard. Anatomie Comparée. Text and Plates. I. V. Williamson Fund.

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Dana, E. S. A Text-Book of Mineralogy. The Conarroe Fund.

Dana, J. D. An Account of the Discoveries in Vermont Geology of the Rev. Aug. Wing. Also, on the Relations of the Geology of Vermont to that of Berkshire. The Author.

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De Candolle's Cours de Botanique. Heirs of Dr. Jos. Carson.

Decken, C. C. von der. Reisen in Ost-Afrika. 3er Bd., 2 Abth. I. V. Williamson Fund.

Delaharpe, Ph. Quelques Mots sur la Flore Tertiare de l'Angleterre.

Examen de l'Hypothèse de M. D. Sharpe sur l'Existence d'une Mer diluvienne baignant les Alpes.

Ossements Appartenant a l'Anthracotherium magnum.

Note sur un Nouvel Exemplaire de l'Emys Laharpi.

Notice sur la Faune du Terrain Siderolithéque dans le Canton de Vaud.

Note sur la Géologie des Environs de Louèche-les-Bains. The Author.

Delondre et Bouchardat's Quinologie. Heirs of Dr. Jos. Carson.

Department of Agriculture, Monthly Report, Nov. and Dec. 1876. The Department.
Department of Marine and Fisheries, Ca. Supplement No. 3 to the Ninth Annual Report. The Department.
Description des Appareils de Benevides et Brito-Limpo. Portuguese Centennial Commission.
Dobson, G. E. Monograph of the Asiatic Chiroptera. I. V. Williamson Fund.
Dodge, R. I. The Plains of the Great West. Conarroe Fund.
Doelter, C. Die Bestimmung der petrographisch wichtigeren Mineralien durch das Mikroskop. I. V. Williamson Fund.
Douglas, J. W., and J. Scott. A Catalogue of British Hemiptera, Heteroptera, and Homoptera. Entomological Society of London.
Dozy, F., and J. H. Molkenbauer. Bryologia Javanica. Fasc. 46, 47. Wilson Fund.
Dubrueil, E. Catalogue des Mollusques terrestres et fluviatales de l'Hérault. 2d ed. I. V. Williamson Fund.
Duchamp, G. Recherches sur les Ligules. I. V. Williamson Fund.
Dumont D'Urville's Voyage au Pole Sud. Atlas Zool., 26e. Livr. Mineralogie et Geologie, 1e, 2e, 3e Livr. Rathmell Wilson.
Dumortier, E. Études Paléontologiques sur les Dépots Jurassique du Bassin du Rhone. T. 1–4. I. V. Williamson Fund.
Duns, J. On an unnamed Palæozoic Annelid. The Author.
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Eaton, D. C. Plain Directions for collecting Algæ. The Author.
Eaton's Elements of Botany. Heirs of Dr. Jos. Carson.
Edwards, W. H. Catalogue of the Lepidoptera of America north of Mexico. The Entomological Section.
Egger, J. Beschreibung neuer Zweiflügler. The Author.
Elliot's Monograph of the Tetraoninæ. Pts. 1, 2, 4, 5. Rathmell Wilson.
Encyclopædia Britannica. 9th ed. Vols. V. and VI. I. V. Williamson Fund.
Ennis, J. Lecture on the Natural Sciences. The Author.
Erichson, W. F. Naturgeschichte der Insecten Deutschlands, 1e Abth. Coleoptera, 5e Bd. 1e Lief. I. V. Williamson Fund.
Ernst, A. Etudios sobra la Flora y Fauna de Venezuela. The Author.
Etudes Physiologiques sur les Animaux des Infusions Végétals. Tomes 1, 2. I. V. Williamson Fund.
Eyton, T. C. Osteologia Avium. No. 12. Rathmell Wilson.
Fedtschendo, A. Reise in Turkestan. I. and II., 1–11. Zoologischer Th. XI. I. V. Williamson Fund.
Fischer, H. Nephrit und Jadeit. I. V. Williamson Fund.
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Recherches sur les Actinies des Cotes Oceaniques de France. I. V. Williamson Fund.
Folin, L De. Les Méléagrinicoles. Espèces Nouvelles. I. V. Williamson Fund.
Forestry Circulars. Nos. 1, 2, 4, 5. F. B. Hough.
Foster, M., and F. M. Balfour. The Elements of Embryology. I. V. Williamson Fund.
Fresenius' Qualitative and Quantitative Analysis. Heirs of Dr. Jos. Carson.
Frey, H. The Microscope and Microscopical Technology. Translated by Geo. R. Cutter. I. V. Williamson Fund.

Friele, H. Bidrag til Vestlandets Molluskfauna.
Report on Mollusca of the Norwegian North Atlantic Expedition in 1876. The Author.
Friele, H., and G. A. Hansen. Bidrag til Kundskaben om de Norske Nudibranchier.
Fuchs, K. Les Volcans et les Tremblements de Terre. I. V. Williamson Fund.
Gadolin, A. Mémoire sur la deduction d'un seul principe de tous les systèmes crystallographiques avec leur subdivisions. The Author.
Gaimard's Voyage en Islande et au Groenland. Atlas, Mam. Pls. 11, 13, 14, 22. Rathmell Wilson.
Gannett, H. U. S. Geol. Survey. Lists of elevations. 4th ed. Department of Interior.
Garcia, J. A. G. i. El Monitor rebelde Huascar. The Author.
Garrigues, S. S. Report on the Salt Manufacture of Michigan. The Author.
Gassies, J. B. Faune Conchyliologique de la Nouvelle-Calédonie. 2e partie. I. V. Williamson Fund.
Gaudry, A. Materiaux pour l'Histoire des Temps Quaternaires. 1 Fasc. I. V. Williamson Fund.
Gegenbauer, C. Untersuchungen zur vergleichenden Anatomie der Wirbelthiere. 2es Heft. I. V. Williamson Fund.
Genth, F. A. Second Geological Survey of Pennsylvania, 1875.
Second Preliminary Report on the Mineralogy of Pennsylvania. The Survey.
On some Tellurium and Vanadium Minerals. The Author.
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Geological Survey of Great Britain, Memoirs of the. The Iron Ores of Great Britain. I.–IV. I. V. Williamson Fund.
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Geological Survey of India. Records, Vol. 9; Pts. 2, 3, 4.
Memoirs, 8vo. Vol. 12. Pts. 1, 2.
Memoirs, 4to. Palæontologica Indica. Sex. X. 2; XI. 1. The Survey.
Geological Survey of Indiana. Third and Fourth Annual Reports. Dr. G. M. Levette.
Geologist of New Jersey, Annual Reports, 1870, '71, '74, '75, '76. The Author.
Geological Survey of New Zealand. Reports, 1873–4, 1874–6, 1876–7. Maps of the Buller Coal Field. James Hector.
Geological Survey of Pennsylvania, 1875. Reports of progress CC, HH, and L. The Commissioners.
Gesner, Wm. Alabama geological sections of the Warrior and Cahaba coal measures. The Author.
Gervais, H., et R. Boulart. Les Poissons. Vols. 2, 3. I. V. Williamson Fund.
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Die Saugethiere. 2e Ausg.; 1e, 2e Hälfte. I. V. Williamson Fund.
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Gmelin's Handbook of Chemistry. 19 volumes. Heirs of Dr. Jos. Carson.
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International Exhibition, 1876. Arkansas State Building; Catalogue of Exhibits. Chas. S. Keyser.

Catalogue of the Russian Section.

Portuguese Special Catalogues. Departments I.–V. Portuguese Commission.

Irby, L. H. L. The Ornithology of the Straits of Gibraltar. I. V. Williamson Fund.

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Japanese Botany. Fac-simile. Heirs of Dr. Jos. Carson.

Jardine, Sir W. Naturalists' Library. Natural History of Man. Animals—Vols. 1, 3, 4, 6, 8, 9, 11, 12. Birds—1, 3, 5, 6, 7, 12, 13. Humming Birds, 3; Fishes, 5, 6; Insects, 5. I. V. Williamson Fund.

Jardine and Selby's Illustrations of Ornithology. Vols. 1, 2, 3. Rathmell Wilson.

Jeffreys, J. G. New and peculiar Mollusca of the Pecten, Mytilus, and Arca families procured in the Valorous Expedition. The Author.

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Knapp's Chemical Technology. Heirs of Dr. Jos. Carson.

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Die Geographische Verbreitung der Binnenmollusken. The Author.

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Librarian of Congress. Annual Report, 1876. The Author.

Library of His Excellency, Sir Geo. Grey. 2 vols. H. C. Coates.

Light-House Board. Annual Report, 1876. Treasury Department.

Liliencron, Freihrn. R. v. Ueber den Inhalt der Allgemeinen Bildung in der Zeit der Scholastik. Royal Academy of Sciences of Munich.

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Report of a Reconnaissance from Carroll, Montana Territory, on the Upper Missouri, to the Yellowstone National Park and return, made in the summer of 1875. War Department.

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Monographic Revision and Synopsis of the Trichoptera of the European Fauna. Pts. 1-6, and Supplement I. I. V. Williamson Fund.
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Marsh, O. C. Introduction and Succession of Vertebrate Life in America. The Author.
Martens, E. v. Die Preussische Expedition nach Ost-Asien. Zoologische Abth., 1er Bd., 2e Halfte. I. V. Williamson Fund.
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National Printing Office at Lisbon, 1876. Portuguese Centennial Commission.
Nevill, G. List of the Mollusca brought back by Dr. J. Anderson from Yunnan and Upper Burma, with descriptions of new species. The Author.
New Jersey State Board of Agriculture. Fourth Annual Report, 1876. Geo. H. Cook.
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Annual Report of the Department of Mines, 1875. N. S. W. Centennial Commission.
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Note sur les Phénomènes de la Digestion et sur la Structure de la pareil Digestif chez les Phalangides.
Les Voyages des Naturalistes Belges. The Author.
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Public Libraries of the United States. Special Report. Parts I. and Bureau of Education
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Rafinesque, C. S. Caratteri di alcuni nuovi generi e nuove specie di ani e piante della Sicilia, 1810.
Alsographia Americana.
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Twenty plates of fishes and plants.
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Hints for the Preservation of Specimens of Natural History for museum purposes.
Zoology of the Chevert. The Author.
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Notiz über die mikroskopische structur der Hagelkorner.
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Die Meteorsteine.
Reise der Osterreichischen Fregatte Novara um die Erde. Zoologischer Theil, Bd. I., Bd. II., 2e Abth. A. und B.; 2e Abth. Text und Atlas; 3e Abth. Geologischer Theil, Bd. I.; 1e und 2e Abth., Bd. II. Anthropologischer Theil, 1, 2, und 3e Abth. Linguistischer Theil. Botanischer Theil, Bd. I. Medicinischer Theil, Bd. I. Nautisch-physicalischer Theil, 1–3e Abth. Statistisch-commercieller Theil, Bd. I. und II.
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Revista de Obras Publicas e Minas. I.–VI. Laurenco Malheiro.
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Rougemont, Ph. de. Etude de la Faune des eaux privées de lumière. I. V. Williamson Fund.
Rowley. Ornithological Miscellany. 5–9. I. V. Williamson Fund.
Royal Botanic Garden, Edinburgh. Report for 1876. The Society.

Rüdinger, Prof. Dr. Beitrage zur vergleichenden Anatomie und Histologie der Ohrtrompete. I. V. Williamson Fund.

Rüss, Dr. K. Die fremdländischen Stubenvögel. 5e und 6e Lief. I. V. Williamson Fund.

Russel's National History of Aleppo. Heirs of Dr. Jos. Carson.

Rutgers Scientific School. Twelfth Annual Report. T. A. Conrad.

Rutherford, Wm. Outlines of Practical Histology. I. V. Williamson Fund.

Sadebeck, A. Angewandte Krystallographie. I. V. Williamson Fund.

Salter, J. W. A Catalogue of the Collection of Cambrian and Silurian Fossils contained in the Geological Museum of the University of Cambridge. I. V. Williamson Fund.

Sandberger, C. L. F Die Land- und Süsswasser Conchylien der Vorwelt. I. V. Williamson Fund.

Sars, G. O. On some remarkable forms of animal life from the great deeps of the Norwegian coast. II. University of Christiania.

Saussure, H. De. Rapport sur le Concours Agricole, 1876. The Author.

Synopsis of American Wasps. The Smithsonian Institution.

Fedtschenko's Voyage au Turkestan. Orthopteres. The Author.

Sawkins, J. G. Reports on the Geology of Jamaica. I. V. Williamson Fund.

Schabus, J. Bestimmung der Krystallgestalten. I. V. Williamson Fund.

Scheffler, H. Die Naturgesetze und ihr Zusammenhang mit den Prinzipien der abstrakten Wissenschaften. The Author.

Schenk, S. L. Mittheilungen aus dem embryologischen Institute der k. k. Universität in Wien. 1 Heft. I. V. Williamson Fund.

Schlegel, H. Museum d'Histoire Naturelle des Pays-Bas. 2me, 8me, et 9me Livr. I. V. Williamson Fund.

Schleiden's Principles of Botany. Heirs of Dr. Jos. Carson.

Sclater, P. L., and O. Salvin. Nomenclator Avium Neotropicalium. I. V. Williamson Fund.

Schmidt, A. Atlas der Diatomaceen-kunde. 11–14 Heft. I. V. Williamson Fund.

Schomburgh, R. Botanical Reminiscences in British Guiana. I. V. Williamson Fund.

School of Mines, Record of. Vol. 1; Pts. 1, 3, and 4. I. V. Williamson Fund.

School Almanac, 1876. H. C. Coates.

School-Books and Testaments in South African Dialects. H. C. Coates.

School of Mines, Ballaarat. Annual Report, 1876. The Council.

Schrauf, A. Lehrbuch der Physikalischen Mineralogie. I. und II. Bd. I. V. Williamson Fund.

Schrenck, L. v. Reisen und Forschungen im Amur-Lande. Bd. 4; 2e Lief. Wilson Fund.

Scudder, S. H. The Insects of the Tertiary Beds at Quesnel. The Author.

On the Classification of Butterflies. The Author.

Report upon the Orthoptera collected by the expedition for geographical survey west of the 100th meridian during field season of 1875. The Author.

Schübeler, F. C. Die Pflanzenwelt Norwegians. Dr. Alf. Fricke.

Same. University of Christiania.

Schulz, D. G. Atlas Geologico y Topografico de Asturias. Geological Survey of Spain.

Seidlitz, G. Die Otiorhynchiden s. str. nach den morphologischen Verwandtschaftsverhältnisse ihres Hautscelet's vergleichend. The Author.

Semper, C. Entwickelungsgeschichte der Ampullaria polita. Rathmell Wilson.
Reisen im Archipel der Philippinen. 2er Th.; 2er Bd. 11 Heft. I. V. Williamson Fund.
Seue, C. de. Windrosen des sudlichen Norwegens. University of Christiania.
Seynes, J. De. Recherches pour servir à l'Histoire Naturelle des Vegetaux Inférieures. I. Des Fistulines. I. V. Williamson Fund.
Sharp, S. Rudiments of Geology. I. V. Williamson Fund.
Shelly, G. E. A Handbook of the Birds of Egypt. I. V. Williamson Fund.
Siebke, H. Enumeratio Insectorum Norvegicorum. Fasc. 3, 4. University of Christiania.
Siebold, C. Th. v. Anatomy of the Invertebrata. Translated by Waldo J. Burnett. I. V. Williamson Fund.
On a true Parthenogenesis in Moths and Bees. Rathmell Wilson.
Smith's Grammar of Botany. Heirs of Dr. Jos. Carson.
Smith, E. F. Upon some new Chlorine Derivatives from Toluol.
Tri-substitution Derivatives of Benzol.
Dichlorsalicylic Acid. The Author.
Smith, F. British Hymenoptera Aculata. Entomological Society of London.
Smith, J. Historia Filicum. I. V. Williamson Fund.
Smithsonian Institution. Contributions to Knowledge. Vols. 20, 21.
Smithsonian Report, 1875. The Institution.
Smucker, I. Centennial History of Licking County, Ohio. The Author.
Sommerville, M. Engraved Gems. Jas. L. Claghorn.
Sowerby, J. De C., and E. Lear. Tortoises, Terrapins, and Turtles. I. V. Williamson Fund.
Souverbie, Dr. Description d'espèces nouvelle de l'Archipel Caledonien. The Author.
Spencer, H. Descriptive Sociology. Div. I., Nos. 3, 4, 5. Conarroe Fund.
Spinzig, C. Cholera. The Author.
Spry, W. J. J. The Cruise of the "Challenger." Conarroe Fund.
Squier, Geo. Peru; incidents of travel and exploration in the land of the Incas. The Conarroe Fund.
Stearns, R. E. C. Remarks on the death of Col. Ezekiel Jewett and Dr. P. P. Carpenter. The Author.
Steiner, L. H. Am I my brother's keeper? The Author.
Stevens, E. T. Jottings on some of the objects of interest in the Stonehenge excursion, Thursday, Aug. 24, 1876. The Author.
Strebel, H. Beitrag zur Kenntniss der Fauna Mexikanischer Land- und Süsswasser-Conchylien. II. Th. I. V. Williamson Fund.
Streets, T. H. Contributions to the Natural History of the Hawaiian and Fanning Islands and Lower California. The Author.
Summer's Botany. Heirs of Dr. Jos. Carson.
Swan, Jos. Illustrations of the Comparative Anatomy of the Nervous System. I. V. Williamson Fund.
Tasmania. Statistics and Council Journal. E. C. Nowell.
House of Assembly Journals, and map of. H. M. Hull.
Another map of. W. Moore.
Chart of Water-Works, Hobart Town. A. Randall.
Charts of Hobart Town and Launceston. Messrs. Walch & Son.
Another chart of Launceston. S. F. Dibbs.
Photographs of Public Buildings. Corporation of Launceston.

Tate, R., and J. F. Blake. The Yorkshire Lias. I. V. Williamson Fund.
Teixeira de Aragao, A. C. Descripçao geral e historica das moedas cunhadas em nome dos Reis, Regentes e Governadores de Portugal. Laurenco Malheiro.
Theophastri de Historia Plantarum, 1644. Heirs of Dr. Jos. Carson.
Thielens, A. Description de la Collection de la Marquise Paulucci. I. V. Williamson Fund.
Thomas, T. G. A Case of Abdominal Pregnancy treated by Laparotomy. The Prophylactic Treatment of Placenta prævia. The Author.
Thomson, C. G. Opuscula Entomologica. Fas. 5, 6, 7. I. V. Williamson Fund.
Hymenoptera Scandinaviæ. Tome IV. I. V. Williamson Fund.
Thornton's Botany. Heirs of Dr. Jos. Carson.
Titford's Hortus Botanicus Americanus. Heirs of Dr. Jos. Carson.
Tomes, C. S. A Manual of Dental Anatomy, Human and Comparative. Conarroe Fund.
Tommasi, D. Ricerche fisico-chemische sui diffirenti stati allotropici dell' idrogeno. The Author.
Les Bateaux Hemi-plongeurs. The Author.
Torlonia, A. The Draining of Lake Fucino. The Author.
Torrey and Gray's Flora of North America. Vol. I., Pts. 3, 4; Vol. II., Pts. 1–4. Heirs of Dr. Jos. Carson.
Trafford, F. W. C. Amphiorama, ou la Vue du Monde. The Author.
Trautschold, H. Ergänzung der Fauna des russischen Jura. The Author.
Trumbull, J. H., and Asa Gray. Notes on the History of Helianthus tuberosus. The Authors.
Trumpp, E. Nānak, der Stifter der Sikh-Religion. Royal Academy of Sciences of Munich.
Trustees of S. African Museum. Official Reports, 1857–75. H. C. Coates.
Tschamer, A. Zur Pathogenese des Keuchhustens. The Author.
Turner's Elements of Chemistry. Heirs of Dr. Jos. Carson.
Turner, W. Lectures on the Comparative Anatomy of the Placenta. I. V. Williamson Fund.
Tyge Brahe's Meteorologiske Dagbog. Royal Academy of Copenhagen.
United States Commission of Fish and Fisheries. Part III. Report for 1873–4, and 1874–5. The Commissioner.
United States Entomological Commission. Bulletin, Nos. 1, 2. Department of the Interior.
U. S. Geological Survey of the Territories. Miscellaneous publications, Nos. 2, 4, 7, 8. Bulletin No. 4, 2d Series II., 4; III. 1–4.
Ninth Annual Report, 1875.
Contributions to North American Ethnology. Department of the Interior.
United States Life-Saving Service. Annual Report, 1876. Treasury Department.
U. S. National Museum. Bulletin, Nos. 7, 8, 9. Department of Interior.
Untersuchungen der Deutschen Meere in Kiel. Jahresbericht 1, 2, 3. I. V. Williamson Fund.
Valuation of Property, Hobart Town and Launcetown. Tasmanian House of Assembly.
Van Benneden, J. A. Repertorium Annuum Literaturæ Botanicæ. Tome I. I. V. Williamson Fund.
Van Beneden, P. J. Faune Littorale de Belgique, Cétacés et Turbellariés. Rathmell Wilson.
Manifestation en l'honneur de van Beneden, P. J. The Committee.

Van Beneden et Gervais, MM. Osteographie des Cétacés Vivants et Fossiles. Text and Plates, Livr. 14. Wilson Fund.
Van Vollenhoven, S. C. Snellen. Pinacographia. Pts. 4 & 5, Afl. 5. I. V. Williamson Fund.
Vaughan, V. C. Notes on the Osteology and Myology of the Domestic Fowl. Conarroe Fund.
Vennor, H. G. Our Birds of Prey. Wilson Fund.
Vidal y Soler, S. Memoria Sobra les Montes de Filipinas. The Author.
Villa, A., et G. G. Lo Studio degli Insetti in Lombardo. Gita Geologica sugli Appennini Centrali.
Virey's Philosophie de l'Histoire Naturelle. Heirs of Dr. Jos. Carson.
Vogt, C. Recherches sur les Animaux Inferieurs de la Mediterranée. I. V. Williamson Fund.
Waern, C. F. Minnesteckning ofver Augustin Ehrensvärd. Royal Swedish Academy.
Walker, E. Terrestrial and Cosmical Magnetism. Conarroe Fund.
Walker's Statistical Atlas. Conarroe Fund.
Weddell's Histoire Naturelle des Quinquinas. Heirs of Dr. Jos. Carson.
Weinkauff, H. C. Catalogue der im Europaischen Faunen-gebiet lebenden Meeres-Conchylien. I. V. Williamson Fund.
Weismann, A. Zur Naturgeschichte der Daphniden. I.–IV. I. V. Williamson Fund.
Wetherby, A. G. Review of the genus Tulotoma. The Author.
Whitfield, R. P. Preliminary Report on the Paleontology of the Black Hills. Department of Interior.
Wilder, B. G. On the Brain of Chimaera monstrosa. The Author.
Williamson, A. N. Observations on Nasal Catarrh. The Author.
Withering's Botanical Arrangement. Heirs of Dr. Jos. Carson.
Witter, F. M. Catalogue of Iowa Mollusca. The Author.
Wood, H. The Shores of Lake Aral. I. V. Williamson Fund.
Woodbridge, W. E. Report on the Mechanical Properties of Steel. The Author.
Woodward, H. B. The Geology of England and Wales. I. V. Williamson Fund.
Wythe, J. H. The Microscopist. 3d ed. Conarroe Fund.
Yarrell, W. A History of British Fishes. 3d and 4th eds., by Sir John Richardson. I. V. Williamson Fund.
Yarrow, H. C. Report upon the Collection of Terrestrial and Fluviatile Mollusca made in Colorado, Utah, etc., in 1872, '73, '74. The Author.
Zigno, A. de. Flora fossilis formationis volithicæ. Rathmell Wilson.
Zirkel, F. United States Geological Exploration of the Fortieth Parallel. Microscopical Petrography. War Department.
Zittel, K. A. Studien über fossile Spongien. The Author.
Zoological Record. Vol. 12. Wilson Fund.

JOURNALS AND PERIODICALS.

Amsterdam. K. Akademie van Wetenschappen. Jaarbook, 1875.
Verslagen en Mededeelingen. Afd. Nat. 2e. Reeks, Tiende Deel. Afd. Let. 2e Reeks, Vifde Deel.
Verhandelingen. Zestiende Deel; Afd. Let., Tiende Deel.
Catalogus van de Boekerii, III. 1.
Processen-Verbaal, 1875–76.

K. Zoologisch Genootschap "Natura Artis Magister." Nederlandsch Tijdschrift voor de Dierkunde. Jahrg. I., Afl. 6-12, Deel II.-IV. The Society.

Angers. Société Nationale d'Agriculture, Sciences et Arts. Mémoires. T. 18me. The Society.

Ann Arbor Scientific Association. Constitution and By-Laws. The Society

Augsburg. Naturhistorische Verein. 24er Bericht. The Society.

Auxerre. Société des Sciences Historiques et Naturelles de l'Yonne. Bulletin, 30e vol. The Society.

Baltimore. Peabody Institute. Tenth Report. The Society.

Bamberg. Naturforschende Gesellschaft. Elfter Bericht. The Society.

Belfast. Natural History and Philosophical Society, Proceedings, 1876. The Society.

Berlin. Archiv für Naturgeschichte. 42er Jahr; 2es und 3es Heft 4; 34 Jahrg. 1; 39 Jahrg. 1; 6es Heft; 40er Jahrg.; 5es Heft 6; 42er Jahrg. 2es; 43er Jahrg. 2es Heft. The Editor.

Botanischer Jahresbericht, 1875. 1er Halfband. I. V. Williamson Fund.

Deutsche Geologische Gesellschaft. Zeitschrift, XXVIII. 3; XXIX. 2. The Society.

Gesellschaft Naturforschender Freunde. Sitzungsberichte, 1876. The Society.

K. P. Akademie der Wissenschaften. Monatsbericht, Aug. 1876; July, 1877. The Society.

Entomologische Zeitschrift. 20er Jahrg. 2es Heft, 21er Jahrg. 1. The Editor.

Der Naturforscher. X. Jahrg., 2-32. The Editor.

Verein zur Beförderung des Gartenbaues in den K. P. Staaten für Gärtnerei und Pflanzenkunde. Monatsbericht, 19er Jahrg. The Society.

Bloomington. Illinois Museum of Natural History. Bülletin No. 1. S. A. Forbes.

Bologna. Accademia delle Scienze del' Istituto. Rendiconto, 1875-76. Memorie. Serie 3. VI. 1-4. The Society.

Bonn. Archiv für Mikroskopische Anatomie. XIII. 3, 4; XIV. 1, 2. I. V. Williamson Fund.

Naturhistoriche Verein der preussischen Rheinlande und Westphalens. Verhandlungen, 32er Jahrg. 2e Hälfte; 33er Jahrg. 1e Hälfte. The Society.

Bordeaux. Société des Sciences Physiques et Naturelles. Bulletin, 2e Série, t. I. 3. The Society.

Société Linnéenne. Actes, 4me Série; t. XVIII. 4; t. XIX. 1. The Society.

Boston. American Academy of Arts and Sciences, Proceedings. New Series, IV. The Society.

American Naturalist. Jan. to Nov. 1877. The Editor.

Science Observer. I. 1, 4. The Editor.

Society of Natural History. Proceedings, XVIII. p. 337; XIX. 158. Memoirs. II., Pt. 4, No. 5. The Society.

Braunschweig. Archiv für Anthropologie. 3er Bd. 3, 4; 9er Bd. 4; 10er Bd. 3. I. V. Williamson Fund.

Bremen. Naturwissenschaftliche Verein. Abhandlungen. V. 2. The Society.

Schwedische Heilgymnastische Institut. XX. Jahresbericht. The Director.

Bristol. Naturalists' Society. Proceedings, III. 1-9; IV. 1, 2; V.; VI. 1, 2; VII. 1, 2. N. S., I. 1-3; 1868-76. By-Laws, etc. The Society.

Bruxelles. Société Belge de Microscopie. Bulletin, I.; Annales, II.; Procès Verbal, Nos. 4-6. The Society.

Société Entomologique de Belgique. Compte-Rendu. Série II., 31-42. The Society.

Société Malacologique de Belgique. Annales, t. 19me. The Society.

Buffalo. Society of Natural History. Bulletin, III. 4. The Society.

Caen. Académie National. Mémoires, 1876. The Society.

Calcutta. Stray Feathers. Vols. 1-3; vol. 4, pt. 1. I. V. Williamson Fund.

Cambridge. Museum of Comparative Zoology. Memoirs, Vol. I.

Annual Report, 1876. The Director.

Nuttall Ornithological Club. Bulletin II. 1-4. The Society.

Peabody Museum of American Archæology and Ethnology. Tenth Annual Report. The Trustees.

Psyche. II. 33-38. The Editor.

Cap Rouge. Naturaliste Canadien. Nov. 1876 to Oct. 1877. The Editor.

Caracas. Gaceta Cientifica de Venezuela. I. 5-9. The Editor.

Cassel. Malakozoologische Blatter. XXIII. Bg. 10; XXIV. 9. I. V. Williamson Fund.

Catania. Accademia Gioenia di Scienzi Naturali. Atti, serie 3a, t. X. The Society.

Cherbourg. Société Nationale des Sciences Naturelles. Compte-Rendu de la Séance de 30 Dec. 1876. The Society.

Christiania. Nyt Magazin for Naturvidenskaberne. 21e B., 3e Heft-22e B., 4e Heft. The Editor.

Videnskab Selskab. Forhandlinger. 1875. The Society.

Cincinnati. Quarterly Journal of Science. Vols. 1, 2. Cincinnati Society of Natural History.

Society of Natural History. Proceedings, 1876, 1. The Society.

Copenhagen. K. D. Vidensakaberne Selskab. Oversigt, 1875, Nos. 2, 3; 1876, No. 1; 1877, No. 1.

Mémoires, 5me Série; Classe des Sciences, XI. 3, 4. The Society.

Société Royale des Antiquaires du Nord. Mémoires, 1875-76.

Tillaeg til Aarbger, 1874-75. The Society.

Videnskabelige Meddelelser fra Naturhistorisk Forening, 1876. The Editor.

Danzig. Naturforschende Gesellschaft. Schriften, Neue Folge, 2en B., 2es Heft; 4en B., 1es Heft. The Society.

Darmstadt. Verein für Erdkunde. Notizblatt, III. Folge, 15er Band, Nr. 169-180. The Society.

Dorpat. Naturforscher-Gesellschaft. Sitzungsberichte, IV. 2.

Archiv für die Naturkunde Liv-, Ehst- und Kurlands. 1e Serie, 3er B., 1er Lief.; 5er B., 2e-4e Lief; 7er B., 5e Lief., und Meteorologische Beobachtungen, 1e-3e Lief.; 8er Band, Heft 2. II.e Serie, Biol.-Naturb., B. 7, Lief. 3. The Society.

Dresden. Afrikanische Gesellschaft. Correspondenzblatt, No. 21. The Society.

K. Leopoldinisch-Carolinische Akademie der Naturforscher. Nova Acta. X. 1, 2; XI. 1, 2; XXXIV., XXXVIII. Leopoldina, 1-6, 11es Heft. The Society.

K. Sammburg für Kunst und Wissenschaft. Bericht, 1874-75. I. V. Williamson Fund.

K. Zoologischen Museum. Mitheilungen. 2es Heft. The Society.
Naturwissenschaftliche Gesellschaft. Sitzungsberichte, 1876; Juli, 1877. The Society.
Drontheim. K. Norske Videnskab Selskab. Skrifter, Ottende Bind, 3e Hefte.
Fortegnelse i Aaret, 1875. The Society.
Dublin. Royal Dublin Society. Journal. Nos. 42–44. The Society.
Royal Irish Academy. Transactions, XXVI. 5. The Society.
Edinburg. Botanical Society. Transactions and Proceedings, XII. 3. The Society.
Geological Society. Transactions, III. 1. The Society.
Royal Society. Proceedings, Session 1875–76.
Transactions. Vol. 27, Pt. 4. The Society.
Erlangen. Physikalisch-medicinische Societät. Sitzungsbericht, 8 Heft. The Society.
Frankfurt, A. M. Aerztlich Verein. Jahresbericht, XIX. und XX. Jahrg. The Society.
Deutsche malakozoologische Gesellschaft. Jahrbücher, 4er Jahrg. 2. Nachrichtsblatt, 9er Jahrag. 4–8. The Society.
Der Zoologische Garten, 1876, Nos. 7–12. The Publishing Society.
Senckenbergische Naturforschende Gesellschaft. Bericht, 1875–76. Abhandlungen, XI., 1es Heft. The Society.
Freiburg i. B. Naturforschende Gesellschaft. Bericht, VII. 1. The Society.
Geneva. Bibliotheque Universelle et Revue Suisse, 1816–1854. 116 volumes. I. V. Williamson Fund.
Schweizerische Paläontologische Gesellschaft. Abhandlungen, Vol. 3. I. V. Williamson Fund.
Société de Physique et d'Histoire Naturelle. Mémoires, XXIV. 2. The Society.
Giessen. Oberhessische Gesellschaft für Natur- und Heilkunde. 15er und 16er Bericht. The Society.
Glasgow. Philosophical Society. Proceedings, X. 2. The Society.
Göttingen. K. Gesellschaft der Wissenschaften und der Georg-Augusts-Universität. Nachrichten, 1876. The Society.
Graz. Verein der Aerzte in Steiermark. Sitzungs-Bericht, XI.–XIII. Vereinsjahre. The Society.
Halifax. Nova Scotian Institute of Natural Science. Proceedings and Transactions, IV. 2. The Society.
Halle. Naturforschende Gesellschaft. Abhandlungen, 13en B., 2es Heft. Bericht, 1875. The Society.
Hamburg-Altona. Naturwissenschaftliche Verein. Abhandlungen, 1876. The Society.
Hanover. Botanical Gazette, II. 4–12. The Editor.
Harlem. Société Hollandaise des Sciences. Archives Néerlandaises, XI. 2, 3. Notice Historique, etc., 1876. The Society.
Hartford. Fanciers' Journal, IV. 3–11. The Editor.
Innsbruck. Ferdinandeum für Tirol und Vorarlberg. Zeitschrift, 3e Folge, 20es Heft. The Society.
Jena. Medicinisch-naturwissenschaftliche Gesellschaft. Jenaische Zeitscrift, Bds. I., IV., 2, 3, 4; Bds. V., VII.; X. 4 und 2er Sup. Heft; XI. 1, 2. The Society.
Kärnten. Naturhistorische Landes-Museum. Jahrbuch, 11es und 12es Heft. The Museum.
Kansas City. Western Review of Science and Industry. March to October, 1877. The Editor.

Königsberg. Physikalisch-ökonomische Gesellschaft. 1875. 1e und 2e Abth. The Society.

Lausanne. Société Vaudoise des Sciences Naturelles. Bulletin, 2e Série, Vol. XIV., Nos. 77, 78. The Society.

Leeds. Geological and Polytechnic Society of the West Riding of Yorkshire. Reports of the Proceedings, 1840, 1851, 1854–5. The Society.

Literary and Philosophical Society. Annual Reports, 1875–76; 1876–77. The Society.

Leipzig. Archiv für Anatomie, Physiologie und wissenschaftliche Medecin, 1873, No. 2; 1876, 4–6. Abth., 1877, 1, 2, 3. Physiologische, 1877, 1, 2. 3. Anatomische, 1877, 1, 2, 3. I. V. Williamson Fund.

Fürstlich Jablonowski' sche Gesellschaft. Preisschriften, XIX. und XX. The Society.

Jahrbücher für wissenschaftliche Botanik. X. 4; XI. 1. I. V. Williamson Fund.

Jahresberichte über die Fortschritte der Anatomie und Physiologie. Hofmann und Schwalbe. Bds. 1–4. I. V. Williamson Fund.

Journal für Ornithologie. 24er Jahrg. 3–25er; Jahrg. 2. I. V. Williamson Fund.

Kosmos. 1er Jahrg., Nos. 1–7. I. V. Williamson Fund.

Morphologische Jahrbuch. II. 3; III. 4. I. V. Williamson Fund.

Naturforschende Gesellschaft. Sitzungsberichte. 2er Jahrg., No. 1 to 1877, No. 1. The Society.

Zeitschrift für Anatomie und Entwickelungsgeschichte. II. 3–6. I. V. Williamson Fund

Zeitschrift für Krystallographie und Mineralogie. I. 1–6. I. V. Williamson Fund.

Zeitschrift für wissenschaftliche Zoologie. XXVII. 4; XXIX. 1, 2, 3. I. V. Williamson Fund.

Leyden. Bidragen tot de Dierkunde. 8e Afl. Rathmell Wilson.

Lille. Société des Sciences de l'Agriculture et des Arts. Mémoires, 1874. The Society.

Liverpool. Literary and Philosophical Society. Proceedings. No. 30. The Society.

London. Annals and Magazine of Natural History. Dec. 1876, Nov. 1877. I. V. Williamson Fund.

Astronomical Register. Jan. to Oct. 1877. I. V. Williamson Fund.

British Association for the Advancement of Science. Report, 1875, 1876. I. V. Williamson Fund.

Curtis's Botanical Magazine. Nos. 1077–1088. I. V. Williamson Fund.

Entomological Society. Transactions, 1876. The Society.

Gardeners' Chronicle. Nos. 151–202. The Editor.

Same. Vols. 1–32. I. V. Williamson Fund.

Geological Magazine. Nov. 1876 to Oct. 1877. I. V. Williamson Fund.

Geological Society. Quarterly Journal, Nos. 128–131. List, 1876. The Society.

Grevillea. Vols. 3, 4. The Editor.

Hardwicke's Science Gossip. 143–154. I. V. Williamson Fund.

Hooker's Journal of Botany. I.–IV. Heirs of Dr. Jos. Carson.

Ibis. Oct. 1876; July, 1877. I. V. Williamson Fund.

Same. I.–V., and n. s. I. 2. 3, 4. Rathmell Wilson.

Journal of Anatomy and Physiology. X. 1—XII. 1. I. V. Williamson Fund.

Journal of Botany, British and Foreign. Nov. 1876 to Oct. 1877. I. V. Williamson Fund.
London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science. 5th Series. Dec. 1876 to Nov. 1877. I. V. Williamson Fund.
Mineralogical Magazine. No. 2. The Editor.
Monthly Microscopical Journal. Dec. 1876 to Oct. 1877. I. V. Williamson Fund.
Nature. Nos. 369–420. The Editor.
Notes and Queries. Nov. 1876 to Oct. 1877. The Editor.
Palæontological Society's publications. Vol. XXX. Wilson Fund.
Popular Science Review. January, April, July, October, 1877. I. V. Williamson Fund.
Quarterly Journal of Conchology. Nos. 8, 9, 10. The Editor.
Quarterly Journal of Microscopical Science. January, April, July, October, 1877. I. V. Williamson Fund.
Quarterly Journal of Science. 1864–1876, and January to July, 1877. I. V. Williamson Fund.
Royal Asiatic Society of Great Britain and Ireland. Journal. IX. 1, 2. The Society.
Royal Geographical Society. Proceedings, XXI. 1–6.
Journal. Vols. 45, 46. The Society.
Royal Horticultural Society. Journal, IV. 16. The Society.
Royal Institution of Great Britain and Ireland. Proceedings, VIII. 1, 2. The Society.
Royal Society. Proceedings, XXII. 151; XXV. 175.
Philosophical Transactions. 1874, Pt. 1; 1876, Pt. 1. Lists, etc. The Society.
Society of Arts. Journal, vol. 24. The Society.
Trübner's Literary Record. Nos. 114, 115; 120–128. The Publishers.
Zoologist. Aug. 1864 to Oct. 1877. I. V. Williamson Fund.
Zoological Society. Transactions, IX. 10–X. 2
Proceedings, 1876, Pt. 4; 1877, 1, 2. The Society.
London, Ca. Canadian Entomologist. VIII. 11–IX. 10. The Editor.
Louvain. Université Catholique. Annuaire, 1877, and fifteen theses. The University.
Madison. Wisconsin Academy of Sciences, Arts, and Letters. Transactions, II. and III. The Society.
Manchester. Literary and Philosophical Society. Proceedings, vols. 13, 14, 15.
Memoirs. 3d ser., vol. 5. The Society.
Mauritius. Royal Society of Arts and Sciences. Transactions, n. s., vol. 9. The Society.
Metz. Academie. Mémoires, 56e année. The Society.
Mexico. Museo Nacional. Anales, I. 1. The Museum.
Milan. Reale Istituto Lombardo di Scienze e Lettre. Rendiconti, serie 2; VII. 17–XVIII. 20.
Memorie, Classe di Scienze Mathematiche e Naturali. XIII. 2. The Society.
Mons. Société des Sciences des Arts et des Lettres du Hainaut. IVe Série, T. 1er.
Montpellier. Academie des Sciences et Lettres. Mémoires de la Section des Sciences. VIII. 3, 4. The Society.
Montreal. Canadian Antiquarian. V. 3, July. October. The Editor.
Canadian Naturalist. N. S. VIII. 3–5. The Editor.

Münster Westfälische Provinzial-Verein für Wissenschaft und Kunst. Jahresbericht der Zoologischen Section. 1876–77. The Society.

Munich. K. B. Akademie der Wissenschaften. Sitzungsberichte. 1875, III.–1877, I. Mathematisch-physikalischen Classe.

Abhandlungen. Mathematisch-physikalischen Classe. 12en Bandes 1e und 2e, Abth. 3e. Philosopisch-physikalischen Classe. 13en Bandes, 3e Abth., 14er B., 1e Abth. Historischen Classe. 13en Bandes, 1 Abth. 2e. The Society.

K. Sternwarte bei München. Annalen, XXI. B.

Beobachtungen. 37 Jahrg. The Observatory.

Nancy. Société des Sciences. Bulletin, Série II., T. 2, Fasc. 5. The Society.

Naples. Reale Istituto d'Incorraggiamento alle Scienze Naturali, Echonomiche e Technologiche. 2a serie, XII., XIII. De' Lavori, 1876. The Society.

Neubrandenburg. Verein der Freunde der Naturgeschichte in Meklenberg. Archiv, 30er Jahrg. The Society.

Neuchatel. Société des Sciences Naturelles. Bulletin, X. 3. The Society.

New-Castle-upon-Tyne. Natural History Transactions of Northumberland and Durham. V. 3. The Society.

New Haven. American Journal of Science and Arts. Dec. 1876 to Nov. 1877. The Editor.

New York. American Chemist. VII. 3–9. The Editor.

American Geographical Society. Bulletin, 1876–77; 2, 3. The Society.

American Journal of Microscopy. I., II. 1–11. I. V. Williamson Fund.

American Library Journal. I. 1–II. 2. I. V. Williamson Fund.

Annual of Science and Industry, 1876. I. V. Williamson Fund.

New York Medical Journal. Dec. 1876 to Nov. 1877. The Editor.

Popular Science Monthly. Jan. to Dec. 1877; Supplements, 1–7. The Editor.

Sanatarian, Dec. 1876. The Editor.

Science Observer. I. 2. The Editor.

Torrey Botanical Club. Bulletin, VI. 24–34. The Society.

Orleans. Société d'Agriculture, Sciences, et Arts. Mémoires, XVIII. 3. The Society.

Palermo. Societa di Scienze Naturali ed Economiche. Bollettino, No. 3, 1877. The Society.

Paris. Annales des Mines. 7me Série, X. 4; XI. 3. Minister of Public Works, France.

Same. 4me, Série IX. et X.; 6me Série. XVIII. 5, 6; XIX. 1, 2, 3; 7me, Série III. 1, 2; VIII. 4. Same through Wm. S. Vaux.

Annales des Sciences Geologique. T. 8me. The Editor.

Annales des Sciences Naturelles. Botanique. 6me Série, III., Nos. 1–3. Zoologique. 6me Série. IV.–V. 4, 5.

Archives de Zoologie expérimentale et générale. V. 2; VI. 1. I. V. Williamson Fund.

Journal de Conchyliologie. 3e Série, XVI. 3–XVII. 3.

Journal de Micographie. 1re Année, No. 1. The Editor.

Journal de Zoologie. V. 6–VI. 3. I. V. Williamson Fund.

Revue de Geologie. XII., XIII. The Editor.

Revue Mensuel de Médécin et de Chirurgie. 1. 1. The Editor.

Revue Scientifique de la France et de l'Étranger. 2e Série, 6me Année, No. 22; 7me Année, No. 19. The Editor.

Société d'Acclimatation. Bulletin, 3e Série, III 4–IV. 9. The Society.
Société Botanique de France. Bulletin, T. 21me, pp. 241 et seq. Session d'Anger, 1875, T. 23me; Rev. Bibl. A. B. C. D. E.; T. 24me 1; Rev. Bibl. A.; Comptes Rendus, 2, 3, 4. The Society.
Société Geologique de France. Bulletin, 3me Série IV. et V. 1–6. The Society.
Société Zoologique de France. Bulletin, 1e Année; 2e–2e Année; 2e Partie. The Society.

Philadelphia. Academy of Natural Sciences. Proceedings, 1877, III.
Journal. VIII. 2, 3. The Publication Committee.
American Entomological Society. Transactions, vol. 5, pp. 177 et seq. The Society.
American Journal of Pharmacy. Dec. 1876 to Nov. 1877. The Editor.
American Pharmaceutical Association. Proceedings, Twenty-fourth Annual Meeting. The Society.
American Journal of the Medical Sciences. Jan. to Oct. 1877. The Editor.
American Philosophical Society. Proceedings. Vols. XV., XVI., Nos. 98, 99.
Dental Cosmos. Dec. 1876 to Nov. 1877. The Editor.
Franklin Institute Journal. Dec. 1876 to Nov. 1877. The Society.
Gardener's Monthly. Dec. 1876 to Nov. 1877. The Editor.
Medical News and Library. Nos. 408–418. The Editor.
Penn Monthly. Dec. 1876 to Nov. 1877. The Editor.
Geological Society of Pennsylvania. Transactions, I. 1. J. S. Phillips.
International Medical Congress. Transactions, 1877. The Editor.
The Road. Vols. 1, 2. The Editor.
Zoological Society. Fourth and Fifth Annual Reports. The Society.

Prag. K. B. Gesellschaft der Wissenschaften. Sitzungsberichte, 1875, 1876. Jahresbericht, 12 Mai, 1876.
Abhandlungen, 6e Folge, 8er Bd. The Society.

Regensburg. Flora, 34er Jahrg. The Publishing Society.
Zoologische-mineralogischer Verein. Correspondenzblatt. Jahrg. 8, 9, 10, 13, 29. The Society.

Rio de Janeiro. Brazilian Biographical Annual. Vols. 1–3. The Editor.

Rome. R Accademia dei Lincei. Transunti. I. 1–7. The Society.

Rotterdam. Bataafsch Genootschap der Proefonder vindelike Wijsbegeerte. Nieuwe Verhandlungen, 2e Reeks, 2e Deel, 2e Stuk. The Society.

St. Petersburg. Académie Impériale des Sciences. Mémoires. 7e Série, XII. 11, 12; XIII. 2–8; XVI. 1–3.
Bulletin. T. XXII. 1–XXIII. 2. The Society.
Physikalische Central-Observatorium. Annalen, 1875. The Observatory.

Salem. American Association for the Advancement of Science. Proceedings, 25th meeting. The Association.
Essex Institute. Bulletin. VIII. 3–IX. 6. The Society.

San Francisco. California State Geological Society. Articles of Incorporation and By-Laws, 1876. The Society.

'S Gravenhage. Nederlandsche Dierkundige Vereeniging. Tijdschrift, 1e Deel, Jahrg. 1874, 3 und 4 Afl.; 2e Deel, 1–4 Afl. The Society.

Stettin. Entomologische Verein. Zeitung, 37er Jahrg. The Society.

Stockholm. K. S. Vetenskaps-Akademien. Handlingar, 1874–75, 13e B., 14e B., 1a Häftet.

Bihang. 3e B, 2e Häfte.
Ofversigt, 33 Argangen. The Society.

Stattgart. Neues Jahrbuch für Mineralogie, Geologie und Palæontologie, 1876. 4es 1877, 6es Heft.
Württembergische naturwissenschaftliche Jahresheft. 33er Jahrg., 1-3 Heft. The Editor.

Sydney. Royal Society of New South Wales. Transactions and Proceedings, vol. 9. Rules and List of Members, 1877. The Society.

Tasmania. Royal Society. Papers, Proceedings, and Report, 1875. The Society.

Toronto. Canadian Journal of Science, Literature, and History. XV. 4-7 The Editor.
Entomological Society of the Province of Ontario. Report, 1876. The Society.

Toulouse. Société d'Histoire Naturelle. Bulletin, 1875-76. The Society.

Trieste. Società Adriatica di Scienze Naturali. Bollettino, No. 3. Annata II., Vol. 3, No. 1. The Society.

Upsal. K. Vetenskaps Societeten. Nova Acta. Ser. 3, X. 1. The Society.
Observatoire de l'Université. Bulletin Meteorologique. Vol. VII. The Observatory.

Venezia. Reale Istituto Veneto di Scienze, Lettere ed Arti. Serie 5a, T. 1, Disp. 8, 9. The Society.

Vienna. Anthropologische Gesellschaft. Mittheilungen. VI. 5-10; VII. 1-6. The Society.
K. Akademie der Wissenschaften. Mathem.-Naturw. Classe. Denkschieften, 36er Bd.
Sitzungsberichte, 71 Bd., 3e Abth. 3-5 Heft; 72 Bd. 1e-3e Abth.; 73 Bd. 2e Abth. 1-3 Heft. The Society.
K. K. Geologische Reichsanstalt Jahrbuch. XXVI. 3-XXVII. 2.
Verhandlungen, 1874, Nos. 14, 15; 1876, No. 11; 1877, No. 10.
Abhandlungen. VII., Bd. 4; IX. Bd. The Society.
K. K. Zoologisch-botanische Gesellschaft. Verhandlungen, Bd. 7er, 26er, und Jahrg. 1858. The Society.
Embryologische Institut der K. K. Universität. Mittheilungen, 1 Heft. The Society.
Obst-und Garten-Zeitung, 2er Jahrg., 10es Heft. The Editor.
Oesterreische Botanische Zeitschrift. XXVII. 1. The Editor.
Ornithologische Verein. Mittheilungen, I. 1, 2. The Society.
Verein zur Verbreitung Naturwissenschaftlicher Kenntnisse. Schriften, B. 11, 12, 15, 17. The Society.

Washington. Field and Forest, Feb. 1877. The Editor.

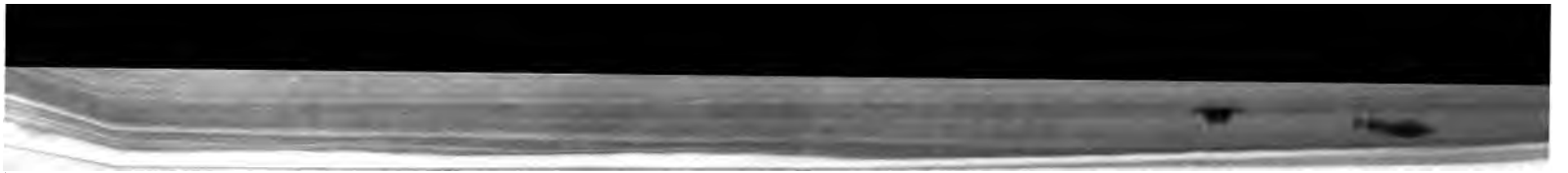
Wellington. New Zealand Institute, Transactions and Proceedings. Vol. 9. The Society.

Worcester. American Antiquarian Society. Proceedings, Nos. 67-69. The Society.
Society of Antiquity. Proceedings, No. 1. The Society.

Würzburg. Botanischen Institut. Arbeiten. 1er Band. The Society.
Physikalisch-medicinische Gesellschaft. Abhandlungen, XI. 1, 2. The Society.
Zoologisch-Zootomische Institut. Arbeiten, II. 1-IV. 1. I. V. Williamson Fund.

Yokohama. Asiatic Society of Japan. Transactions. Vol. 4. The Society.

Zurich. Naturforschende Gesellschaft. Vierteljahresschrift, 19er und 20er Jahrg. The Society.



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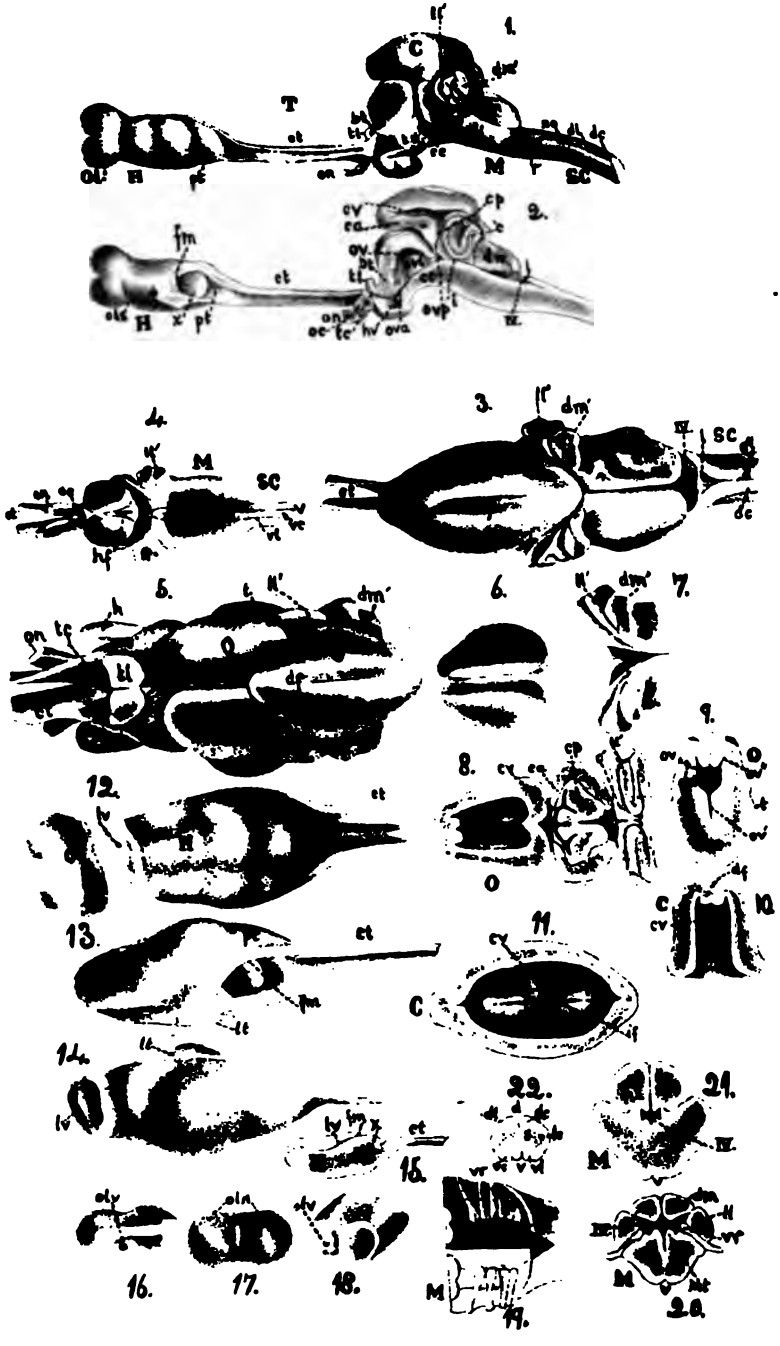

Wilder on Brain of Chimæra.

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OF

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**Cooper, Lewis*, March, 1867.
**Cope, Alfred*, July, 1856.
*Cope, Caleb, Jan. 1848.
*Cope, Edward D., July, 1861.
*Cope, Francis R., Feb. 1867.
*Cope, Miss R. A., Feb. 1867.
*Cope, Thomas P., Feb. 1867.
*Corlies, S. Fisher, May, 1868.
Correa de Serra, Joseph, Feb. 1814.
Corse, James M., M.D., Nov. 1852.
Covey, Edw. N., M.D. (N.R.), Dec. 1857.
*Cox, James S., June, 1859.
Coxe, Alexander S., Feb. 1815.
*Coxe, Brinton, Dec. 1859.
*Coxe, Charles S., April, 1867.
Coxe, Eckley B., Jan. 1865.
*Craig, Andrew C., May, 1877.
Cram, Gen'l F. J., Oct. 1859.
Cramp, C. H., June, 1876.
*Crease, Orlando, May, 1867.
Cresson, Caleb, Feb. 1871.
*Cresson, Chas. Caleb, Sept. 1840.
*Cresson, Ezra T., April, 1858.
**Cresson, John C.*, April, 1853.
Cross, C. W., Jan. 1877.
**Crozer, John P.*, March, 1862.
Cruice, Robert B., M.D., Dec. 1874.
Cruice, Wm. B., M.D., Jan. 1876.
Cuesta, Fernando de la (N.R.), Nov. 1844.
*Cummins, Daniel B., June, 1857.

Curtin, Roland G., M.D., Nov. 1871.
Curtis, Edw., M.D. (N.R.), July, 1863.
Curtis, Josiah (N.R.), June, 1843.
*Cuyler, Theodore, Feb. 1869.

*Da Costa, J. C., M.D., Feb. 1852.
Da Costa, John C., Jr., June, 1857.
Da Costa, John C., Sr., June, 1857.
Dallam, David E., Nov. 1874.
Darby, John T., M.D. (N.R.), March, 1859.
Darlington, Wm. M. (N.R.), Nov. 1868.
Darrach, Jas. A., M.D., Nov. 1858.
Darrach, Wm., M.D., May, 1844.
Davids, Hugh, Dec. 1866.
*Davidson, Geo., Aug. 1858.
Davis, Chas., M.D. (N.R.), March, 1842.
Davis, David Jones, June, 1815.
Davis, John C., June, 1859.
Davis, William M., Jr., Oct. 1875.
Day, Richard H., Nov. 1871.
De Figaniere, Alfonso (N.R.), Mar. 1866.
*Deitz, Rudolph, Jan. 1821.
*Dickeson, M. W., M.D., Oct. 1846.
*Dickey, Rev. Charles A., April, 1876.
Dickson, S. Henry, M.D. (cor.), Feb. 1843.
*Diffenbaugh, E., Dec. 1865.
*Dimpfel, F. P., April, 1858.
*Dixon, George B., March, 1876.
*Dobson, Judah, Nov. 1813.
Dock, Geo., M.D. (N.R.), Feb. 1854.
*Dougherty, James, Oct. 1874.
*Dougherty, Wm. H., Nov. 1870.
Dow, John M. (N.R.), Sept. 1858.
Downie, T. C. (N.R.), Aug. 1859.
Doyle, John, Sept. 1872.
*Draper, Edmund, May, 1853.
Drayton, Henry E., M.D., April, 1858.
*Dreer, Ferdinand J., April, 1857.
*Drexel, Jos. W., June, 1860.
Drown, T. M., M.D., May, 1872.
Ducachet, Rev. H. W., D.D., April, 1852.
*Dulles, Joseph H., Feb. 1816.
Dulty, William, Feb. 1869.
Dundas, Jas., Aug. 1844.
Dunglison, Richard A., M.D., May, 1874.
*Dunglison, Robley, M.D., Jan. 1853.
Dunglison, Thos. R., M.D., April, 1872.
Dunlap, Thomas, Dec. 1856.
Dunn, Nathan (corres.), June, 1828.
Durand, Elias, April, 1852.
Durborrow, Chas. B., March, 1866.
*Dutilh, Charles, Oct. 1874.
Dutton, Clar. Ed., Lt. U. S. A., Feb. 1871.

*Earp, Thomas, March, 1867.
Eastwick, Edward P. (N.R.), May, 1857.
Eberle, John, M.D., April, 1819.
*Eckfeldt, John, M.D., March, 1876.
*Eckstein, H. C., M.D., U. S. N., June, 1873.
*Edwards, Amory (N.R.), March, 1852.
Edwards, Arthur M. (N.R.), Sept. 1858.
*Edwards, Edward B., Jan. 1867.
Edwards, J. Warner, May, 1875.
Egbert, Daniel, M.D., U. S. N., October, 1858.
Eisenbrey, W. Harrison, March, 1870.
*Ellet, Chas., Jr., April, 1842.
Elliot, D. G. (N.R.), May, 1860.
*Ellmaker, Levi, April, 1829.
Elwyn, Alfred L., M.D., Dec. 1831.
Emerson, G., M.D., Aug. 1853.
Emlen, Harry, June, 1869.
Emlen, J. Norris, April, 1859.
Endlich, Frederick W. (N.R.), June, 1871.
England, James B., July, 1875.
*Ennis, Jacob, Feb. 1857.
*Erben, Peter C., April, 1873.
Evans, Edm. C., M.D. (N.R.), Oct. 1838.
Evans, Rowland E., Nov. 1860.

Fagan, Hugh I., Jan. 1875.
*Fahnestock, Geo. W., Aug. 1852.
Farnum, J. Edwards, Jan. 1867.
*Farnum, John, May, 1853.
*Fell, J. G., May, 1853.
Feltus, Henry J., Nov. 1859.
Fenimore, Jason L., June, 1866.
Field, Thos. Y. (N.R.), Aug. 1859.
Fiot, Augustus, Jan. 1864.
Fischer, Emil, M.D., Nov. 1868.
*Fisher, Charles Henry, May, 1853.
Fisher, Ellicott, April, 1875.
*Fisher, Harvey, June, 1876.
Fisher, Henry M., M.D., Jan. 1876.

*Fisher, Jas.C., M.D. (N.R.), July, 1850.
*Fisher, J. Francis, May, 1853.
*Fisher, Joseph, May, 1821.
Fisher, Thomas, April, 1824.
*Fitler, Edwin H., M.D., Jan. 1876.
Fogg, Isaac S., April, 1869.
Foltz, Jonathan, M.D., U.S.N., May, 1859.
*Foote, Albert E., M.D., July, 1876.
Ford, John, Dec. 1866.
Forwood, W. H., M.D., U. S. A., Oct. 1876.
Foster, Hudson S., Jan. 1834.
Foster, Wm. A., Nov. 1833.
Foulke, Wm. Parker, Nov. 1849.
*Fox, Joseph M., Dec. 1873.
*Fox, Wm. Logan, Jan. 1873.
Frampton, L. A., M.D. (N.R.), Sept. 1859.
Francfort, Eug., M.D. (N.R.), Oct. 1856.
Frazer, John F., Sept. 1835.
*Frazer, Persifor, Jr., May, 1869.
*Frazer, Robert, Jan. 1866.
*Frazier, Robert, April, 1814.
*Freedly, Wm. G., April, 1872.
Fricke, Albert, M.D., Nov. 1859.
*Frost, John, Sept. 1844.
Fry, Horace B. (N.R.), Dec. 1859.
Fry, J. Reese, Jan. 1857.
*Furness, H. H., Nov. 1861.

Gabb, Wm. M. (N.R.), Jan. 1860.
Gambell, Wm., M.D., Aug. 1843.
*Garrett, Philip C., Feb. 1866.
Garrigues, S. S., M.D. (N.R.), June, 1856.
Genth, Fred. A., M.D., April, 1852.
Gentry, Thos. G., Sept. 1870.
*Gerhard, Wm. W., M.D., Nov. 1835.
Germain, Lewis J. (N.R.), April, 1846.
Gibbons, Charles, Jan. 1867.
Gibbons, Wm. P. (N.R.), Nov. 1833.
Gibbs, George, (N.R.), Jan. 1856.
*Gibson, Henry C., July, 1867.
*Gibson, John, July, 1867
*Gibson, Miss Rebecca, March, 1875.
Gihon, A. L., M.D., U. S. N., Dec. 1871.
Gilbert, Wm. K., M.D., May, 1866.
*Gilliams, J., M.D. (found.), Jan. 1812.
Gillingham, Joseph E., May, 1872.
Gillis, J. P., Commodore U.S.N., Nov. '71.
Givin, R. M., M.D., Dec. 1874.
Gobrecht, W. H., M.D. (N. R.), July, 1856.
Goddard, Kingston, Rev. (N.R.), Jan. 1848.
Goddard, Kingston G., M.D., April. 1873.
Goddard, Paul B., M.D., Feb. 1829.
*Godey, Louis A., May, 1874.
Godman, John D., M.D., July, 1821.
*Goldsmith, Edward, Jan. 1868.
Goodman, Henry Ernest, M.D., Jan. 1877.
Gorgas, Albert C., M.D., U. S. N., Feb. '57.
Gowen, F. B., April, 1872.
*Graeff, John E., Feb. 1866.
*Graff, Frederic, May, 1853.
*Graham, Mrs. Elizabeth V., Oct. 1874.
*Grant, Gen. Ulysses S., July, 1865.
Grant, Wm. Robertson, M.D., Dec. 1849.
*Grant, Wm. S., Dec. 1866.
*Gratz, Robert H., April, 1867.
*Greble, Edwin, Jan. 1867.
Greenbank, Richard M., M.D., Oct. 1859.
*Greene, F. V., M.D., U. S. N., Sept. 1852.
*Greene, Stephen, Sept. 1875.
Greer, James, March, 1869.
Grier, Wm. P., M.D., June, 1859.
Griffith, J. P. Crozer, Feb. 1876.
Griffith, R. Egglesfield, M.D., May, 1815.
*Griffith, Robert E., Sept. 1852.
Griffith, Robt. E., M.D., Oct. 1856.
*Grigg, John, May, 1853.
Griscom, Samuel S., Nov. 1830.
Gross, Saml. D., M.D., Dec. 1856.
Grubb, Edw. Burd (N.R.), April, 1860.
*Guex, John A., Nov. 1854.
Guier, George, M.D. (N.R.), June, 1866.
Guillou, Constant, March, 1854.
Guillou, Victor, Oct. 1856.
Gumbes, Sam. Wetherill, April, 1834.
Gumbes, Wm. H., May, 1870.
Gutekunst, Frederick, June, 1871.

*Haddock, Daniel, Jr., May, 1866.
*Haehnlen, Lewis, April, 1873.
Hagedorn, C. F., Aug. 1855.
*Haines, Miss Ann, Feb. 1867.
*Haines, Miss Jane R., Feb. 1867.
*Haines, John S., March, 1841.
*Haines, Reuben, Nov. 1813.

*Haines, Reuben, May, 1874.
*Haines, Robt. B., Jan. 1848.
Haldeman, Rich. J. (N.R.), Aug. 1857.
*Haldeman, S. S. (N.R.), Jan. 1837.
Hall, Augustus R., April, 1873.
Hall, Charles E., Feb. 1875.
Hallowell, Caleb S., Jan. 1869.
**Hallowell, Edw.*, M.D., Feb. 1834.
*Hallowell, Morris L., May, 1853.
**Halsey, Wm. S.*, M.D., April, 1857.
Hamilton, Hugh, M.D. (N.R.), May, 1874.
*Hammitt, B., June, 1867.
*Hand, James C., July, 1860.
Hanson, H. Cooper, Feb. 1853.
Hare, H. Binney, M.D., Aug. 1867.
**Hare, Robert*, M.D., Nov. 1813.
Hare, Robt. H., Feb. 1859.
Hargadine, R.W., M.D. (N.R.), May, 1868.
**Harlan, Richard*, M.D., Oct. 1815.
Harlow, Louis D., M.D., Aug. 1857.
Harmar, James Lanman, Aug. 1869.
**Harris, Edward* (N.R.), Aug. 1835.
**Harrison, Joseph, Jr.*, Aug. 1854.
Harrison, Theodore L., Feb. 1870.
Hart, Harry C., M.D., March, 1858.
Hartman, John M., Feb. 1873.
*Hartshorne, Chas., Feb. 1866.
Hartshorne, Edw., M.D., May, 1847.
Hartshorne, H., M.D. (N.R.), April, 1855.
*Haseltine, Frank, May, 1867.
*Haseltine, John, April, 1859.
*Haseltine, Ward B., April, 1859.
Hassler, F. A., M.D., 1867.
*Hawkins, B. Waterhouse, Aug. 1868.
*Hay, William, April, 1867.
Hayden, F.V., M.D. (corres.), Mar. 1856.
*Hayes, Isaac I., M.D. (N.R.), Jan. 1856.
*Hays, Isaac, M.D., July, 1818.
*Hazard, Joseph P., Nov. 1872.
Hazard, Saml. (corres.), Jan. 1814.
Heerman, Adolphus L., M.D., April, 1845.
Heger, Anthony, M.D. (N.R.), Feb. 1867.
Helfenstein, J. S., June, 1876.
**Hembel, William*, Sept. 1824.
Henderson, A. A., M.D., U. S. N. (cor.), July, 1848.
Henry, Bernard, M.D., May, 1849.
*Henszey, George C., March, 1869.
*Henszey, W. C., Jan. 1859.
Hentz, N. M. (N.R.), May, 1819.
Hepburn, Jas. (N.R.), June, 1863.
*Hering, C., M.D. (corres.), Oct. 1826.
Hering, C. J. (N.R.), Sept. 1855.
Hess, Robert, M.D., May, 1876.
*Heuston, Geo. (N.R.), March, 1870.
*Hewson, Addinell, M.D., Jan. 1853.
Hibler, W. Grier, Nov. 1871.
Hiester, J. P., M.D. (N.R.), Nov. 1843.
Hilgard, T. C., M.D. (N.R.), Oct. 1854.
Hinkle, A. G. B., M.D., Sept. 1867.
*Hockley, Mrs. Amelia D., Oct. 1874.
*Hockley, Thomas, May, 1874.
*Hoffman, C. J., Sept. 1873.
Hoffman, W. I., M.D., Nov. 1874.
Holman, D. Shepherd, May, 1872.
**Holmes, Chas.*, Feb. 1838.
Holt, J. F., M.D., June, 1868.
Hooper, Wm. H., M.D., Dec. 1854.
*Hoopes, B. A., Feb. 1856.
Hoopes, Josiah, April, 1866.
Hopkinson, Joseph, M.D., Feb. 1852.
*Horn, Geo. H., M.D., July, 1866.
Horn, Wilbur F. (N.R.), Dec. 1869.
**Horner, Wm. E.*, M.D., Feb. 1849.
Hornor, Ellen, May, 1870.
*Horstman, F. Oden, May, 1875.
**Horstmann, Wm. J.*, Dec. 1863.
*Houston, H. H., April, 1867.
Howell, Rev. J. B. (N.R.), Sept. 1873.
Howell, Saml. B., M.D., Nov. 1855.
Huffnagle, Chas., M.D. (N.R.), Nov. 1830.
Hugel, A. (N.R.), Sept. 1865.
Humphrey, H. C., Dec. 1875.
Humphrey, Rev. Z. M., Nov. 1869.
*Humphreys, Geo. A., Sept. 1855.
*Hunt, J. Gibbons, M.D., July, 1858.
Hunt, Wm., M.D., Jan. 1855.
*Hunter, Chas. T., M.D., Jan. 1870.
*Huston, Samuel, May, 1866.
*Hutchinson, Jas. H., M.D., April, 1858.
**Hutchinson, J. Pemberton*, May, 1853.
Jackson, Isaac R., Aug. 1841.
James, Bushrod W., M.D., Oct. 1870.

*James, Thos. C., M.D., March, 1814.
Janeway, J. H., M.D. (N.R.), Sept. 1858.
Janney, Nathaniel E., April, 1873.
*Jaudon, Samuel (N.R.), Jan. 1836.
Jayne, Eben C., Dec. 1866.
*Jayne, Horace F., Feb. 1876.
*Jeanes, Miss Anna T., May, 1875.
*Jeanes, Joseph, May, 1853.
*Jeanes, Joshua T., Dec. 1866.
*Jeanes, Miss Mary, May, 1875.
*Jeanes, Samuel, Jan. 1856.
Jefferis, Wm. W., Nov. 1874.
Jenkins, Wilson M. (N.R.), Jan. 1867.
*Jenks, Wm. P., Feb. 1871.
*Jessup, Alfred D., April, 1872.
*Jessup, Augustus E., Nov. 1818.
*Jessup, Edw. A., Nov. 1857.
Johnson, Christopher (N.R.), Dec. 1858.
Johnson, Walter R. (N.R.), Feb. 1827.
Johnstone, Alex., March, 1860.
*Jones, Jacob P., March, 1875.
Jones, Thos. P., M.D., Dec. 1812.
*Jordan, John, Jr., Jan. 1851.
Judson, Oliver A., M.D., Oct. 1858.
Justice, A. R., June, 1876.

Kane, Elisha K., Jan. 1843.
Kane, John K., M.D. (N.R.), April, 1859.
Keagy, J. M., M.D., Jan. 1843.
*Keating, Wm. H., April, 1816.
*Keating, Wm. V., M.D., Jan. 1853.
*Keehmle, Wm. C., March, 1866.
Keen, Wm. W., Jr., M.D., April, 1867.
Keffer, Fred. A., M.D. (N.R.), Nov. 1864.
Keim, Geo. De B., Jan. 1874.
Keim, Geo. M. (N.R.), July, 1852.
Keller, Wilhelm, M.D., Nov. 1848.
Kelly, Howard A., July, 1875.
Kendall, Prof. E. Otis, March, 1860.
*Kenderdine, Robt. S., M.D., May, 1866.
*Kennedy, Elias D., Aug. 1867.
Kennicott, R. (corres., N.R.), April, 1858.
Kern, Benj. J., M.D., Sept. 1847.
Kern, Edward M. (N.R.), Oct. 1847.
Kern, Richard H., May, 1847.
*Kilvington, Robert, April, 1843.
King, Chas. R., M.D., June, 1843.
King, Wm. M., M.D. (N.R.), Oct. 1863.
King, Wm. S., M.D. (N.R.), July, 1863.
Kingsbury, Chas. A., M.D., March, 1860.
*Kingsley, I. E., May, 1874.
Kinsman, Chas. W., Feb. 1865.
Kitchen, J. S., M.D., U. S. N., June, 1858.
*Klett, Frederick, Dec. 1865.
*Kneass, Wm., May, 1814.
Kneeland, S., Jr., M.D. (N.R.), May, 1858.
*Knight, Edw. C., May, 1867.
Knight, J. B., Nov. 1875.
*Knight, J. Frank, Feb. 1863.
Koenig, George A., M.D., Nov. 1872.
Krauth, C. P., Nov. 1872.
*Krider, John, March, 1859.

*Laing, Henry M., June, 1876.
*Lambert, John, Nov. 1846.
Lamborn, R. H., May, 1857.
Land, John (N.R.), May, 1836.
Lang, Edmund, M.D., April, 1853.
Langstroth, Rev. L. L. (N.R.), Sept. 1851.
*Lankenau, Frank W., Dec. 1873.
*Lea, H. C., Feb. 1848.
*Lea, Isaac, LL.D., June, 1815.
Lea, John, May, 1815.
*Lea, Joseph, June, 1852.
*Lea, M. Carey, Sept. 1847.
*Lea, Thos. T., May, 1853.
Le Conte, John (corres.), Feb. 1815.
*Le Conte, J. L., M.D. (corres.), Feb. 1845.
Leeds, Albert R. (N.R.), Dec. 1866.
Leeds, Josiah W., Dec. 1867.
Leffman, Henry, M.D., Sept. 1872.
*Leidy, Joseph, M.D., July, 1845.
Leisenring, John, Oct. 1874.
*Lejée, Wm. R., Feb. 1848.
*Lennig, Francis, July, 1851.
*Lennig, Nicholas, Jan. 1875.
*Lenning, Chas., Oct. 1847.
Lesley, J. P., June, 1853.
*Lesueur, Chas. A., Jan. 1818.
Letterman, J. C., M.D. (N.R.), Jan. 1859.
Levick, James J., M.D., Jan. 1867.
*Lewis A. J., May, 1853.
*Lewis, Chas. S., April, 1866.
Lewis, Edward, March, 1868.

*Lewis, Elisha J., M.D., July, 1846.
*Lewis, Francis W., M.D., Oct. 1849.
*Lewis, Geo. T., Dec. 1863.
Lewis, Grace Anna, May, 1870.
*Lewis, Henry C., March, 1875.
*Lewis, John T., March, 1876.
Lewis, Richard A., Nov. 1871.
Lewis, Samuel, M.D., Oct. 1855.
*Lewis, Samuel G., Sept. 1875.
*Lewis, Saunders, March, 1859.
Leypoldt, F. (N.R.), March, 1862.
*Lilly, William, March, 1874.
*Lippincott, Joshua, April, 1859.
*Lippincott, Joshua B., June, 1853.
*Little, Amos R., March, 1866.
*Little, James H., April, 1867.
*Livezey, John, Feb. 1867.
*Logan, J. Dickinson, M.D., Mar. 1853.
*Long, Mrs. E. P., March, 1867.
Longstreth, Joshua, June, 1815.
*Longstreth, Wm. W., Feb. 1860.
Lorenz, W., Feb. 1863.
*Lovering, Jos. S., Jr., Feb. 1867.
*Lovering, Joseph S., May, 1853.
*Ludlow, John L., M.D., Nov. 1847.
Lukens, Isaiah, June, 1812.
Luther, Diller, M.D. (N.R.), Oct. 1854.
Lyman, Benj. Smith (N.R.), Aug. 1865.

Macalester, Charles, Jan. 1873.
*McAllister, Jas. W., Feb. 1876.
M'Allister, John, Jr., June, 1856.
McAllister, W. Mitchell, Nov. 1868.
M'Call, Gen. G. A.(corres.), June, 1847.
McCanles, John, April, 1859.
M'Clellan, J. H. B., M.D., Nov. 1847.
**Mc Clure, Wm.*, July, 1812.
McCombs, R. S., M.D., Nov. 1875.
McCook, Rev. H. C., Aug. 1875.
*McCreary, Geo. D., Dec. 1874.
*McCreary, I. Elmore, Dec. 1874.
*McCreary, J. B., May, 1865.
Macdowell, William G., Oct. 1874.
M'Euen, Chas., Dec. 1834.
McEuen, Chas. Izard, June, 1858.
**M'Euen, Thos.*, M.D., May, 1818.
Macfarlane, Andrew, A.M., Sept. 1873.
Macfarlane, Charles W., Jan. 1874.
Macfarlane, John J., April, 1873.
McGrath, John M., M.D., May, 1875.
McGuire, Jas. C. (N.R.), April, 1857.
*McIntyre, Archibald, Feb. 1871.
*McKean, H. Pratt, April, 1867.
*McKean, Wm. V., Jan. 1875.
*Mackellar, Thos., March, 1877.
McLaughlin, John, Feb. 1871.
**Maclure, Alexander*, Dec. 1840.
M'Michael, Wm., June, 1850.
McQuillen, J. H., M.D., Oct. 1865.
*Mactier, Wm. L., Jan. 1860.
*Magarge, Charles, April, 1867.
*Magee, Horace, Dec. 1867.
*Magee, J. Ronaldson, Dec. 1867.
Maisch, John M., March, 1864.
**Mann, C. M.* (founder), Jan. 1812.
**Markland, John H.*, May, 1839.
Marsh, Benj. V., April, 1857.
**Marshall, Benj.*, Feb. 1867.
**Marshall, Richard M.*, Feb. 1867.
*Martin, Geo., M.D., April, 1857.
*Martin, Jas. S., Feb. 1870.
*Martin, John S., March, 1876.
Martindale, Isaac C., June, 1876.
Martindale, Jos. C., M.D., Jan. 1863.
*Mason, James S., March, 1875.
*Massey, William, May, 1873.
Matthews, Chas. W., Oct. 1867.
**Maule, Daniel*, Oct. 1874.
Maury, F. F., M.D., May, 1868.
Mayburry, Wm., M.D., Oct. 1866.
*Mead, Theodore L. (N.R.), March, 1876.
**Meade, Maj. Gen. Geo. C.*, July, 1865.
Mears, J. Ewing, M.D., Nov. 1870.
*Meehan, Thos., March, 1860.
*Meichel, John, March, 1876.
*Meigs, Jas. Aitken, M.D., April, 1852.
*Meigs, J. Forsyth, M.D., April, 1852.
**Mercer, Singleton A.*, May, 1853.
*Merrick, J. Vaughan, April, 1854.
**Merrick, Saml. V.*, May, 1853.
*Messchert, M. H., June, 1854.
Mickle, Andrew E., M.D., June, 1831.
Mifflin, Geo., March, 1835.
Miller, Adolph W., Aug. 1875.

*Miller, Andrew H., Dec. 1871.
Miller, Clement S., Dec. 1836.
Miller, E. Spencer, May, 1862.
*Miller, Jos. W., May, 1872.
Milliken, Jas., March, 1863.
Millikin, George, July, 1875.
Mills, Chas. K., M.D., Oct. 1870.
Minturn, Edw., M.D., Oct. 1857.
*Miskey, Wm. F., April, 1872.
Mitchell, Ed. Craig (N.R.), July, 1860.
*Mitchell, I. E., Oct. 1874.
**Mitchell, John K.*, M.D., July, 1822.
Mitchell, S. Weir, M.D., Sept. 1853.
Monks, Sarah P., Sept. 1872.
Monnier, Alfred (N.R.), Aug. 1856.
Montgomery, John T., Jan. 1877.
Moore, Alfred, Feb. 1873.
*Moore, Andrew M., July, 1867.
*Moore, B. H., April, 1872.
*Moore, B. H., Mrs., April, 1872.
Moore, Francis, M.D., May, 1860.
Moore, Gideon E., Ph.D., Nov. 1872.
Moore, J. G., July, 1866.
**Moore, Saml.*, M.D., Nov. 1855.
*Moorhead, Wm. G., Dec. 1867.
*Mordecai, E. R., M.D. (N.R.), May, 1860.
Morehouse, Geo. R., M.D., Aug. 1856.
*Morris, Elliston P., Nov. 1875.
Morris, Galloway C., May, 1874.
*Morris, Henry, March, 1862.
*Morris, Henry G., Feb. 1868.
*Morris, Israel, April, 1867.
**Morris, Jacob G.*, April, 1852.
*Morris, J. Cheston, M.D., Oct. 1854.
Morris, John T., April, 1870.
*Morris, Mrs. Levi, April, 1873.
**Morris, Margaretta H.*, Sept. 1859.
*Morris, P. P., May, 1872.
**Morris, Stephen*, Feb. 1868.
*Morris, Theo. H., May, 1867.
*Morris, Wistar, April, 1867.
**Morton, Samuel C.*, March, 1867.
**Morton, Saml. Geo.*, M.D., April, 1820.
Morton, Thos. Geo., M.D., Aug. 1856.
Moss, Theo. F., June, 1845.
Muckle, Alexander, M.D., Jan. 1875.
Muhlenberg, Henry A. (N.R.), Jan. 1874.
Munzinger, Pierre, March, 1876.
Mütter, Thos. D., M.D., July, 1833.
**Myers, John B.*, May, 1853.

Nancrede, Charles B., M.D., June, 1869.
*Neall, Daniel, Dec. 1873.
*Nebinger, A., M.D., July, 1866.
Neff, Chas., M.D., April, 1858.
Neuman, Joseph, Sept. 1873.
Newbold, Thos., M.D. (N.R.), Nov. 1854.
Newkirk, Matthew, Nov. 1867.
*Nichols, Gustavus A., March, 1871.
*Nolan, Edw. J., M.D., April, 1867.
Norris, Geo. W., M.D., May, 1858.
*Norris, Herbert, M.D., May, 1868.
*Norris, Isaac, M.D., Jan. 1861.
**Norris, Octavus A.*, Oct. 1849.
**Norris, Thaddeus*, May, 1858.
**Norris, Wm., Jr.*, Dec. 1830.
*Norris, Wm. F., M.D., May, 1858.

Ogden, Jas. A., M.D., Nov. 1871.
O'Neil, T. Warren (N.R.), Feb. 1871.
**Ord, George*, Sept. 1815.
Orne, Jas. H., Dec. 1865.
Owen, A. M., M.D., U. S. N., Oct. 1874.

Packard, John H., M.D., Nov. 1856.
*Page, Joseph F., April, 1867.
Page, Wm. Byrd, M.D., April, 1853.
*Pancoast, Jos., M.D., Dec. 1847.
Pancoast, Wm. H., M.D., Sept. 1870.
*Parke, Thomas E., M.D., Nov. 1871.
*Parker, Chas. F., Aug. 1865.
**Parmentier, N. S.* (founder), Jan. 1812.
Parrish, Charles, Oct. 1874.
Parrish, Edward, Prof., Dec. 1860.
*Parrish, Jas. C., March, 1866.
Parrish, Wm. D., May, 1858.
Patterson, Francis E., Jan. 1859.
Patterson, J. M., Jan. 1875.
*Patterson, Joseph, Feb. 1867.
**Patterson, R. M.*, M.D., Jan. 1816.
Paul, Jas., M.D., March, 1857.
*Peace, Edw., M.D., April, 1859.
Peale, Charles Wilson, April, 1868.
*Peale, Titian R., Aug. 1817.

Pearsall, Robt., Dec. 1835.
*Pease, James G., Nov. 1874.
Peirce, C. Newlin, D.D.S., Feb. 1868.
Peirce, Gertrude K., April, 1877.
*Peltz, Richard, March, 1868.
Pemberton, Henry, March, 1876.
*Pennock, Mrs. Caroline, Jan. 1873.
**Pennock, C. W.*, M.D. (N.R.), June, 1824.
Pennypacker, I. A., M.D., Sept. 1854.
Pennypacker, I. Towers, Feb. 1875.
Pennypacker, Samuel W., Nov. 1871.
Penrose, R. A. F., M.D., April, 1856.
Penrose, Saml. S., Nov. 1830.
Penrose, T. N., M.D., U. S. N., May, 1873.
Pepper, Geo., M.D., Aug. 1867.
*Pepper, Geo. S., July, 1860.
**Pepper, Henry*, May, 1853.
*Pepper, L. S., M.D., July, 1857.
Pepper, Wm., M.D., Feb. 1837.
Percival, Thomas C., Jan. 1845.
Perot, Charles P., May, 1874.
Peters, Francis, Jan. 1859.
Peterson, Geo. W., Aug. 1859.
*Peterson, Richard, April, 1873.
*Peterson, Robert E., April, 1831.
*Phillips, C. Charles, Feb. 1871.
Phillips, John S., Aug. 1836.
*Phillips, Moro, March, 1867.
**Pierce, Jacob* (N.R.), Dec. 1813.
Piersol, George A., M.D., April, 1876.
*Pine, William S., March, 1876.
Platt, Franklin, Jr., Dec. 1868.
**Platt, Wm.*, May, 1853.
Platt, William G., May. 1875.
Porter, Prof. E. D. (N.R.), Oct. 1857.
*Potter, Thomas, May, 1867.
Potts, Edward, March, 1876.
*Potts, Howard N., Jan. 1873.
*Potts, Joseph D., Nov. 1874.
Potts, Wm. (N.R.), Nov. 1860.
Potts, Wm. John, May, 1877.
*Poultney, Charles W., Oct. 1874.
Powel, John Hare (N.R.), May, 1858.
Powel, Robt. Hare, May, 1862.
Powel, Saml. (N.R.), July, 1847.
*Powers, Thos. H., Dec. 1873.
**Preston, Jonas*, M.D., Jan. 1825.
*Price, Eli K., Nov. 1875.
Price, Isaac C., Nov. 1868.
*Price, J. Sergeant, Feb. 1876.
**Price, Richard*, May, 1853.
Prince, Wm., Capt., U. S. A., Sept. 1872.
Procter, Wm., Jr., Feb. 1867.
**Poulson, Chas. A.*, Sept. 1823.

*Queen, Jas. W., Jan. 1858.
Quimby, B. F., April, 1871.

Rafinesque, C. S., Feb. 1816.
*Ralston, Rev. J. G., May, 1867.
*Rand, B. Howard, M.D., Jan. 1851.
Rand, Theodore D., Sept. 1857.
*Randolph, Evan, Feb. 1867.
**Randolph, Richard*, May, 1814.
Randolph, S. Emlen, Dec. 1865.
**Read, James*, Dec. 1824.
*Reakirt, Edwin L., Jan. 1866.
Reakirt, Tryon, April, 1866.
*Redfield, John H. (corres.), Aug. 1846.
Reece, Davis (N.R.), Nov. 1860.
*Reed, Chas. D., Feb. 1870.
Reeve, Mark M., M.D., March, 1831.
*Reeves, Samuel J., March, 1874.
*Remington, Thos. P., May, 1853.
Rhoades, Edwin, M.D., May, 1868.
*Rhoads, Beulah M., Dec. 1875.
*Rhoads, James M., March, 1876.
*Rhoads, Jos. R., May, 1866.
*Rice, Geo. (N.R.), May, 1870.
*Rice, John, April, 1861.
Richardson, Caleb, Dec. 1814.
Richardson, Joseph G., M.D., Nov. 1868.
Richardson, T. G., M.D. (N.R.), Jan. 1858.
*Ridings, James, Feb. 1876.
*Ridings, James H., Feb. 1876.
**Roach, Joseph H.*, Dec. 1875.
Robb, Richard R., Feb. 1867.
Roberts, Charles, March, 1876.
Roberts, George, M.D. (N.R.), July, 1868.
Roberts, Louisa J., Sept. 1873.
*Roberts, S. Raymond, June, 1866.
Roberts, Solomon W., April, 1860.
Robinson, John B., U. S. N., Oct. 1874.
*Robinson, Thos. A., Sept. 1872.

*Rockhill, Daniel H., May, 1867.
*Rogers, Charles H., Jan. 1876.
Rogers, Fairman, Feb. 1854.
Rogers, Henry D. (N.R.), Nov. 1834.
Rogers, James B., M.D., Oct. 1847.
Rogers, R. E., M.D., Feb. 1837.
**Rogers, W. Frederick*, March, 1855.
Rogers, Wm. B., Jr., Sept. 1870.
*Root, Thomas S., Feb. 1876.
Rosengarten, J. G., April, 1877.
*Rosengarten, Saml. G., May, 1850.
**Rotch, Joseph*, Feb. 1814.
**Rotch, Thomas*, Feb. 1816.
Rothermel, John G., Oct. 1874.
Rothermel, Peter F., Feb. 1875.
Rothrock, J. T., M.D., Dec. 1864.
*Ruschenberger, W. S. W., M.D. (corres.), May, 1832.
Rush, Madison, June, 1855.
Rush, William H., M.D., June, 1873.
Ryan, Thomas, Jan. 1836.
Ryland, K., M.D., Dec. 1857.

**Sanderson, Ed. F.* (N.R.), Sept. 1853.
*Santee, Eugene J., M.D., Sept. 1875.
Sargent, F. W., M.D. (N.R.), Sept. 1847.
Saurman, Benj. F., M.D., Jan. 1863.
**Say, Benjamin*, June, 1813.
*Say, Lucy W. (N.R.), Oct. 1841.
**Say, Thomas* (founder), April, 1812.
Scattergood, Geo. J., Aug. 1863.
*Scattergood, Thos., Jr., Nov. 1862.
*Schaffer, Chas., M.D., March, 1861.
*Schaffer, Wm. L., Dec. 1873.
*Schafhirt, Fred. (N.R.), March, 1853.
Schimmell, Jose O., Oct. 1872.
**Schively, Geo. S.*, M.D., Dec. 1866.
Schmidt, Henry D. (N.R.), Feb. 1858.
Schwarz, G , May, 1874.
*Scott, Thomas A., April, 1867.
Scribner, Frank L., Feb. 1877.
Scull, Gideon D. (N.R.), March, 1857.
*Seal, Thomas F. (N.R.), May, 1852.
Seiler, Karl, M.D., Oct. 1874.
Seitzinger, F. S., April, 1859.
Sellers, Coleman, Dec. 1866.
Sellers, Wm., April, 1866.
*Sergeant, J. Dickinson, Oct. 1847.
*Seybert, Henry, Dec. 1826.
Shallcross, John, May, 1874.
Sharpless, Casper W., Jan. 1852.
*Sharpless, Charles S., Jan. 1876.
*Sheafer, P. W. (N.R.), March, 1853.
Sheppard, Edwin, Dec. 1867.
*Sherman, Roger, June, 1868.
Sherman, W. L., M.D., Oct. 1851.
**Shinn, John. Jr.*(founder), Jan. 1812.
Shoemaker, Benj. (N.R.), Sept. 1835.
Shoemaker, Benj. H., Oct. 1858.
Shoemaker, Geo. Y., Nov. 1867.
Shober, Sam. L., July, 1866.
Shreve, Elizabeth, Feb. 1871.
Shryock, Allen, Nov. 1871.
*Siegfried, C. A., M.D., U.S.N., Jan. 1873.
Simes, J. H. C., M.D., April, 1876.
*Simmons, John (N.R.), July, 1835.
*Sinclair, John C., April, 1869.
Sinnickson, Chas., Jan. 1873.
*Sinnott, Joseph F., Jan. 1868.
Slack, John H., M.D. (N.R.), July, 1857.
*Slaymaker, Samuel E., March, 1866.
*Sloan, Andrew W., May, 1867.
Slocum, Charles E., M.D., June, 1876.
Smallwood, Hannah T., May, 1870.
*Smedley, Samuel L., Dec. 1873.
Smith, A. K., M.D. (N.R.), Nov. 1862.
Smith, Andrew H., M.D., Jan. 1863.
*Smith, Aubrey H., Sept. 1850.
*Smith, Benj. H., March, 1876.
*Smith, Charles, March, 1867.
*Smith, Charles E., June, 1851.
**Smith, Charles W.*, Dec. 1815.
Smith, Daniel B., April, 1870.
Smith, Edgar F., April, 1877.
**Smith, George Washington*, Oct. 1874.
Smith, Green (N.R.), Sept. 1870.
Smith, Henry H., M.D., April, 1859.
**Smith, Jacob R.*, Dec. 1815.
Smith, John B., April, 1834.
*Smith, Joseph P., Feb. 1826.
*Smith, Thomas, June, 1859.
Smith, Thos. Guilford (N.R.), Jan. 1866.
*Smith, Uselma C., Aug. 1868.
*Smith, Walter B., Jan. 1867.

Smyth, Francis Garden, M.D., Nov. 1872.
Smyth, Samuel (N.R.), June, 1855.
Snelling, Samuel, Aug. 1836.
*Sommerville, Jas. M., M.D., Feb. 1858.
*Sommerville, Maxwell, June, 1876.
Souder, Edmund A., Feb. 1857.
**Spackman, George*, M.D., July, 1825.
**Spackman, Rev. H. S.*, July, 1855.
**Sparks, Thomas*, May, 1859.
**Speakman, John* (founder), Jan. 1812.
Spear, J. C., M.D., U. S. N., Aug. 1869.
*Spencer, Charles, April, 1867.
*Spencer, Howard, Feb. 1874.
*Starr, Jesse W., Feb. 1876.
Starr, T. W., May, 1868.
Steel, Francis P., June, 1868.
Steele, J. Dutton (N.R.), Feb. 1863.
Steinhaur, Rev. Dan., July, 1829.
Stellwagen, Thos. C., M.D., March, 1866.
Stephens, Lemuel, May, 1858.
Stephenson, B. F., M.D., U.S.N., Nov. 1875.
*Stetler, John G., M.D., Feb. 1867.
Stevenson, William C., Jr., Dec. 1875.
*Stewardson, Thomas, M.D., April, 1859.
Stewardson, Thos., Jr., Sept. 1870.
Stewart, William (N.R.), June, 1823.
Stewart, Wm. H. (N.R.), Oct. 1858.
Stiles, G., M.D., April, 1872.
Stille, Henry M., M.D. (N.R.), May, 1866.
Stillé, Louis, S., M.D., Nov. 1871.
Stimpson, Wm., M.D., April, 1858.
Stockton, E. B., May, 1815.
Stoddart, Jos. M., Jan. 1877.
Stoddart, J. Marshall, April 1877.
Stokes, William A., May, 1874.
**Stouse, Joseph*, M.D., May, 1812.
*Strecker, Herman, June, 1873.
Streets, Thos. H., M.D., U.S.N., Sept. 1869.
Struthers, William, Feb. 1852.
Swaim, William, Jan. 1872.
*Swift, Joseph, May, 1853.

Taggart, Wm. H., M.D., April, 1853.
*Taitt, Mrs. Caroline G., March, 1875.
*Taitt, John T., May, 1867.
*Tasker, Stephen P. M., Feb. 1868.
*Tasker, Thos. T., Jr., Feb. 1868.
*Tatnall, Edward, Jr., March, 1876.
Taylor, Alfred B., Dec. 1865.
**Taylor, Charles*, March, 1867.
Taylor, Edward, June, 1876.
Taylor, Levi (N.R.), July, 1868.
**Taylor, Rich. C.* (corres.), July, 1832.
Taylor, T. Clarkson, May, 1866.
Taylor, William J., Feb. 1857.
Thomas, Rev. C. F., June, 1877.
*Thomas, Joseph, M.D., April, 1866.
Thompson, E. O., July, 1876.
Thompson, George W., Feb. 1871.
*Thompson, James C., Feb. 1865.
**Thompson, J. Edgar*, Feb. 1831.
**Thompson, John*, April, 1872.
*Thompson, John J., Nov. 1872.
Thompson, Lewis, Feb. 1871.
Thomson, Wm., M.D., June, 1868.
Tompkins, Myron, M.D. (N.R.), May, '58.
Torr, Wm. S., Oct. 1860.
*Tower, C., May, 1873.
**Townsend, John K.*, M.D., Sept. 1833.
*Townsend, Richard H., M.D., Jan. 1873.
*Trautwine, John C., April, 1852.
*Trevor, John B. (N.R.), May, 1867.
*Trimble, Annon D., Jan. 1873.
Troost, Gerard, M.D. (found.), Jan. 1812.
Trotter, Newbold H., Dec. 1865.
Trudeau, James, M.D. (N.R.), Nov. 1835.
Truman, Wm., M.D., May, 1868.
*Tryon, Adeline S., Nov. 1874.
*Tryon, Edw. K., March, 1876.
*Tryon, Geo. W., Jr., June, 1859.
Tuft, John B., M.D. (N.R.), May, 1831.
Turnbull, W. P., July, 1857.
*Turner, John, March, 1866.
Turner, Thos. J., M.D., U.S.N., Feb. 1854.
Turnpenny, Frederick, M.D., Nov. 1833.
*Turnpenny, Jos. C., Dec. 1866.
*Tyler, Geo. F., April, 1867.
Tyndale, Hector, Feb. 1869.
Tyson, James, M.D., Aug. 1867.
Tyson, Job R., May, 1854.

Uhler, Philip R. (N.R.), March, 1858.
Uhler, Wm. H., M.D., Jan. 1856.
Ulke, Henry (N.R.), April, 1858.

Vail, Hugh D., Nov. 1860.
Vanderkemp, John J., M.D. (N.R.), April, 1854.
Vandyke, E. B., M.D., Sept. 1866.
Vanuxem, Lardner, June, 1815.
**Vaughan, John*, March, 1822.
**Vaux, Mrs. E. H.*, Feb. 1867.
*Vaux, George, Dec. 1866.
**Vaux, Roberts*, March, 1818.
*Vaux, William S., March, 1834.

*Wagner, Mary, Feb. 1877.
**Wagner, Tobias*, Oct. 1818.
*Wagner, William, June, 1815.
Wahl, W. H., M.D., Nov. 1870.
Wales, Philip S., M.D., U.S.N., Oct. 1868.
Walker, A. M. (N.R.), April, 1836.
**Waln, S. Morris*, June, 1867.
Walton, Joseph, April, 1866.
**Warden, William S.*, Dec. 1814.
Ware, Nathaniel A. (N.R.), Oct. 1826.
Warner, Benjamin, Feb. 1814.
**Warner, John*, Dec. 1860.
*Warner, Redwood F., Dec. 1864.
Warren, David March, May, 1857.
Warren, Gen. G. K. (N.R.), Feb. 1857.
Waterhouse, John F., M.D., March, 1814.
*Waterman, Isaac S., Dec. 1867.
Watson, Gavin, M.D., April, 1840.
**Watson, Joseph*, May, 1816.
Waugh, W. F., M.D., Jan. 1876.
Weber, R. L., M.D., U.S.N., April, 1866.
*Weightman, John F., M.D., March, 1874.
*Weightman, Wm., Sept. 1856.
*Wells, W. Lehmann, M.D., June, 1863.
*Welsh, John, Dec. 1859.
*Welsh, John, Jr., Dec. 1873.
*Welsh, Samuel, March, 1867.
*Welsh, William, May, 1853.
West, Hilborne, M.D., Sept. 1855.
**Wetherill, Charles*, Nov. 1830.
**Wetherill, C. M.*, M.D. (N.R.), Feb. 1846.
**Wetherill, J. Price*, March, 1817.
Wetherill, J. Price, March, 1871.
Wetherill, Samuel (N.R.), Nov. 1843.
*Wetherill, William, Feb. 1824.
Wharton, Henry, Feb. 1858.
*Wharton, Joseph, July, 1864.
Wharton, William, Jr., June, 1876.
*Wheatley, Chas. M., March, 1850.
*Wheeler, Charles, April, 1867.
*Whelen, Alfred, M.D., Jan. 1876.
*Whelen, Charles S., Jan. 1874.
*Whelen, Edward S., June, 1853.
*Whelen, Jas. N., May, 1867.
*Whelen, Wm. A., May, 1867.
Whelpley, James D. (N.R.), March, 1838.
*Whildin, Alex., May, 1867.
*White, George Geny, Nov. 1874.
*White, S. S., D.D.S., Nov. 1859.
**White, Wm. R.*, Feb. 1866.
*White, Wm. R., Jr., May, 1867.
Whitman, H. F., Oct. 1876.
Whitman, Wm. E., Feb. 1848.
**Whitney, Asa*, May, 1867.
*Whitney, George, May, 1867.
*Whitney, Jas. S., Dec. 1858.
*Whitney, John R., May, 1867.
Wilcocks, Alex., M.D., April, 1857.
Willard, Dwight D., April, 1870.
Willcox, Joseph, Dec. 1867.
Williams, Edward H., June, 1871.
*Williams, Henry J., April, 1819.
Williams, Isaac S., Dec. 1874.
Williams, Samuel H., May. 1859.
*Williamson, Chas. Sumner, May, 1875.
*Williamson, I. V., April, 1867.
Williamson, Passmore, April, 1872.
Williamson, Wm. H., M.D., May, 1875.
Wilson, Alexander, June, 1813.
Wilson, Franklin S., May, 1867.
*Wilson, Joseph, M.D., U.S.N., Jan. 1856.
Wilson, Pierce B. (N.R.), Oct. 1858.
*Wilson, Rathmell, March, 1876.
**Wilson, Thos. B.*, M.D., June, 1832.
**Wilson, Wm. S.*, June, 1848.
**Wilstach, Wm. P.*, July, 1860.
*Wilt, Charles, March, 1876.
*Windrim, James H., Feb. 1876.
*Winsor, Henry, Aug. 1865.
*Wistar, Isaac J., March, 1874.
Wistar, Mifflin, M.D., June, 1839.
**Wistar, Richard*, Jan. 1831.
*Wister, Caspar, M.D., June, 1851.

*Wister, John, April, 1876.
Wister, Owen J., M.D., June, 1859.
Withrow, I. L. (N. R.), April, 1869.
Wolgamuth, Francis F., Feb. 1848.
*Wood, Edw. R., Feb. 1866.
*Wood, George, Dec. 1875.
*Wood, Geo. B., M.D., Feb. 1825.
*Wood, Geo. K., M.D. (N.R.), Jan. 1862.
*Wood, Horatio C., Jr., M.D., June, 1864.
Wood, Richard, Sept. 1860.
**Wood, Richard D.*, May, 1853.
*Wood, Robert, Feb. 1876.
*Wood, Stuart, March, 1876.
Wood, Wm. W. (N.R.), Jan. 1825.
Woodhouse, Sam. W., M.D. Nov. 1845.
Woodward, Geo. W. (N.R.), Jan. 1866.
Woodward, J. J., M.D., U.S.A., June, 1855.
Woollens, Jos., M.D., June, 1815.
Workman, H. Weir, Sept. 1870.
*Wright, Edward, May, 1873.
Wright, George, Capt. U. S. A., Feb. 1870.
Wright, George A., June, 1876.
*Wright, James A., May, 1867.
Wright, Joseph C., Oct. 1873.
Wurts, C. S., M.D., July, 1857.
Wythes, Rev. Jos. H. (N.R.), Nov. 1853.

*Xantus, John Louis (de Vésey), (N.R.), Dec. 1856.

Yarrow, Harry C., M.D., U.S.A., May, '63.
Young, Charles A., Jan. 1875.

Zantzinger, George, Sept. 1835.
*Zantzinger, Wm. S., M.D. (N.R.), Oct. 1840.
Zentmayer, Joseph, May, 1868.
Ziegler, George J., M.D., Nov. 1856.

SUMMARY.

Contributing members	297
Non-resident[1] "	125
Exempt from dues by commutation; or life members[2] .	442
Existing members	864
Deceased members	345

[1] A member who moves his domicil to any locality distant more than thirty miles from the Academy may be released from the payment of the stated dues on application to the treasurer (*By-Laws, Art. V. Chapter IX.*). Members exempted from the payment of dues on this account are termed "non-resident."

[2] A member who has commuted, or expunged the semi-annual claim of the Academy against him during life for stated contributions by the payment of one sum to the "permanent fund" (*By-Laws, Art. III. Chapter IX.*), becomes conventionally distinguished by the title of "life member" on the treasurer's books and on this list. The charter of the Academy provides that "the Society shall consist of *members* and *correspondents*" exclusively. For this reason those who belong to it cannot lawfully assume in this connection any other title, such as "life member," or "corresponding member," or "non-resident member."

CORRESPONDENTS.

Aall, Nicolai, Christiania, Sweden, 1846.
Abadie, E. H., M.D., U. S. A., 1836.
Abadie, Pedro, Lima, Peru, 1821.
Adams, Arthur, London, 1867.
Adams, Charles B., Amherst, Mass., 1846.
Adams, Rev. E. E., Oxford, Delaware County, Pennsylvania, 1867.
Adams, Henry, London, 1867.
Adamson, J. C., M.D., 1856.
Adrian, Robert, LL.D., 1815.
Agardh, Professor C. A., Lund, Sweden, 1834.
Agassiz, Alex. E. R., Cambridge, Mass., 1864.
Agassiz, Professor Louis, Cambridge, Mass., 1836.
Alcantara, Dom Pedro D', Emperor of Brazil, 1876.
Alger, Francis, Boston, 1841.
Anderson, Rev. M. B., LL.D., Rochester, New York, 1866.
Angas, George French, Port Jackson, 1867.
Anthony, John Gould, Cambridge, Mass. 1833.
Antisell, Thomas, M.D., New York, 1852.
Anton, Professor Frak., Hallé, Germany, 1840.
Arago, M., Paris, 1843.
Arriago, José Joaquin, Mexico, 1874.
Auber, Pedro Allessandro, 1835.
Audouin, J. Victor, M.D., Paris, 1821.
Audubon, John James, New York, 1831.
Audubon, John W., New York, 1854.
Audubon, Victor G., New York, 1845.
Avogadro, Amadeo, Turin, 1844.

Bachman, Rev. John, D.D., Charleston, South Carolina, 1832.
Bachmann, Professor Charles Frederick, Jena, Germany, 1840.
Bailey, Professor J. W., West Point, 1841.
Baird, W. M., Reading, Pennsylvania, 1846.
Baldwin, William, M.D., Wilmington, Delaware, 1817.
Balfour, J. Hutton, M.D., Glasgow, Scotland, 1842.
Barabino, Joseph, New Orleans, 1831.

Bárcena, Dr. Mariano, Mexico, 1874.
Barrande, Joachim, Prague, 1859.
Barratt, John P., M.D., Barrattsville, South Carolina, 1847
Barratt, Joseph, LL.D., Middleton, Connecticut, 1837
Barry, Rev. A. C., Racine, Wisconsin, 1853.
Bartlett, John R., New York, 1850.
Bartram, William, Kingsessing, Pennsylvania, 1812.
Baudon, Auguste, M.D., Beauvais, France, 1867.
Baxter, Dr. J. H., U. S. A., Washington, D. C., 1866.
Beaumont, Elie de, Paris, 1833.
Beche, Sir Henry Thomas de la, London, 1832.
Beck, Lewis C., New Brunswick, New Jersey, 1833.
Beck, T. Romeyn, M.D., Albany, New York, 1816.
Bedwell, Thomas, Jr., Rio Janeiro, 1812.
Beebe, Edw. H., Galena, Ill., 1863.
Beelen, A., Pittsburg, Pa., 1812.
Belisario, Dr. John, Sydney, N. S. W., 1875.
Bell, Thomas, London, 1834.
Bellingeri, M., Turin, Italy, 1826.
Belot, Jule Henri, Paris, 1836.
Beneke, Professor F. W., M.D., Hesse Cassel, 1858.
Benoit, Luigi, Messina, 1867.
Benson, H., Cheltenham, Eng., 1867.
Berg, Rev. Dr. Jos. F., Rutgers College, New Jersey, 1868.
Bernardi, Chev. A. C., Paris, 1860.
Berthoud, E. S., Boulder City, Colorado, 1866.
Berzelius, Professor J. Jacob, Stockholm, 1826.
Best, Robert, Lexington, Kentucky, 1823.
Betton, Samuel, M.D., Germantown, 1815.
Beudant, F. S., Paris, 1821.
Bey, Clot, M.D., Cairo, Egypt, 1845.
Bickley, Robert, Pennsylvania, 1816.
Bigsby, John J., M.D., Newark-on-Trent, England, 1820.
Bingham, Wm. T., Boston, Massachusetts, 1868.
Binney, Amos, M.D., Boston, 1836.
Bishop, Nathaniel H., Princeton, N. J., 1869.
Blackmore, William, London, 1869.
Blainville, H. Ducrotay de, Paris, 1817.
Blake, Rev. Joseph, Gilmanton, New Hampshire, 1866.
Blake, W. P., Oakland, Ct., 1856.
Blanchard, M. Emile, Paris, 1848.
Bland, Thomas, New York, 1858.
Blanding, Shubel, M.D., South Carolina, 1836.
Blanding, William, M.D., Providence, R. I., 1831.
Blanding, William, South Carolina, 1836.
Blyth, Edward, Calcutta, 1848.
Boeck, Prof. Carl Wilhelm, Christiania, Norway, 1870.

Boivin, Am., Paris, 1864.
Bonelli, Professor Francisco, Turin, 1818.
Booth, Francis, M.D., London, 1862.
Borie, A. Amicus, Paris, 1821.
Boudin, J. C. M., M.D., Versailles, France, 1845.
Boué, Ami, Paris, 1830.
Bourguignat, M. J. R., Paris, 1867.
Bourne, W. Oland, New York, 1844.
Boynton, Dr. John F., New York City, N. Y., 1868.
Bradbury, John, London, 1817.
Bradley, Prof. Frank H., Knoxville, Tennessee, 1870.
Brady, George Stewardson, Sunderland, England, 1871.
Brandegee, Townsend S., Cañon City, Colorado, 1873.
Brantz, Lewis, Baltimore, Maryland, 1819.
Breneman, A. A., Lancaster County, Pennsylvania, 1868.
Brewer, Thomas M., M.D., Boston, 1841.
Brewer, Wm. H., New Haven, Conn., 1867.
Brewster, David, LL.D., Edinburgh, 1822.
Brevoort, James Carson, Brooklyn, New York, 1847.
Broderip, William J., London, 1836.
Bromfield, William A., M.D., Isle of Wight, 1847.
Brongniart, Adolph T., M.D., Paris, 1821.
Brongniart, Alexandre, Paris, 1812.
Brown, Benjamin B., St. Louis, Missouri, 1837.
Brown, Richard, Sydney, Cape Breton, 1846.
Brown, Samuel, M.D., Alabama, 1818.
Bruce, Archibald, M.D., New York, 1812.
Brücke, Professor E., Vienna, 1854.
Brunet, Rev. Ovide, Quebec, 1865.
Bryan, Col. T. M., Vincenttown, N. J., 1875.
Brydges, Sir Harford J. J., Bart., England, 1848.
Buch, Leopold von, Berlin, 1840.
Buck, Charles Elton, New York, 1866.
Buckland, Rev. William, D.D., Oxford, England.
Buckley, S. B., Austin, Texas, 1871.
Bunbury, Charles J. F., London, 1859.
Burchell, William J., London, 1835.
Burnett, Waldo J., M.D., Boston, 1854.
Burr, John H., M.D., Chiloe, Chili, 1829.
Busch, G. von dem, M.D., Bremen, 1867.
Bustamente, Jose Maria, Mexico, 1828.

Caillaud, Fred., Nantes, 1867.
Caligny, M. Le Mis de, France, 1866.
Campbell, H. Frazer, M.D., Augusta, Georgia, 1858.
Camper, Adrian, Holland, 1821.
Cantor, Theodore, M.D., Singapore, India, 1848.

Capellini, Giovanni, Bologna, 1863.
Carbonell, Celedonio, Porto Rico, 1859.
Carling, E. B., Col. U. S. A., 1869.
Carothers, A. E., M.D., Saltillo, Mexico, 1874.
Carpenter, P. P., Montreal, C. E., 1862.
Carpenter, Wm. B., M.D., London, 1860.
Carpenter, Wm. M., M.D., Louisiana, 1840.
Carr, Robert, Kingsessing, Pennsylvania, 1816.
Carte, Alexander, Dublin, 1869.
Carter, Dr. J. Van A., U. S. Army, 1871.
Carter, Samuel R., Paris Hill, Oxford County, Maine, 1866.
Carus, Professor Charles G., M.D., Dresden, 1837.
Casanova, J. S., M.D., Paris, 1834.
Cass, Lewis, Detroit, 1831.
Castellani, Alessandro, Rome, 1876.
Castillo, Don Antonio del, Mexico, 1874.
Cautley, Major Proby T., London, 1836.
Cavada, F. F., U. S. Consul, Trinidad, 1867.
Chapman, A. W., M.D., Florida, 1861.
Chapman, Isaac, M.D., Bucks County, Pennsylvania, 1813.
Charlesworth, Edward, London, 1841.
Chenu, J. C., Paris, 1867.
Chevreul, E. M., Paris, 1845.
Children, J. G., London, 1836.
Chipman, Isaac L., Horton, Nova Scotia, 1847.
Chittenden, Hon. L. E., New York, 1863.
Chitty, Hon. Edw., Kingston, Jamaica, 1867.
Cist, Jacob, Wilkesbarre, Pennsylvania, 1816.
Claparede, Edw., Geneva, 1859.
Clapp, Asahel, M.D., New Albany, Indiana, 1837.
Clark, Prof. James H., Centre County, Pennsylvania, 1868.
Clark, Lewis Meriwether, St. Louis, Missouri, 1837.
Clay, J. Randolph, London, 1839.
Clemens, Brackenridge, M.D., Easton, Pa., 1859.
Clendon, Major George, Jr., Glenn's Falls, New York, 1868.
Cleveland, Parker, LL.D., Bowdoin College, Maine, 1812.
Clifford, John D., Lexington, Kentucky, 1816.
Clinton, De Witt, LL.D., New York, 1815.
Clinton, Geo. W., Buffalo, 1866.
Cloquet, Jules, Paris, 1816.
Cloquet, Jules (le jeune), Paris, 1819.
Cobb, J., M.D., Kentucky, 1848.
Cobbold, T. Spencer, M.D., London, 1868.
Cocchi, Prof. Igino, Florence, Italy, 1870.
Cogswell, Joseph H., New York, 1816.
Cohen, J. J., M.D., Baltimore, Maryland, 1833.
Colla, Professor Luigi, Turin, 1822.

Collier, D. C., Central City, Colorado, 1866.
Collins, Baron de, Havana, Cuba, 1818.
Combe, George, Edinburgh, 1838.
Conybeare, William D., London, 1836.
Conyngham, R dmond, Lancaster County, Pennsylvania, 1842.
Cook, George H., New Brunswick, New Jersey, 1869.
Cook, M. C., London, 1874.
Cooper, J. G., M.D., San Francisco, Cal., 1867.
Cooper, Thomas, M.D., LL.D., Columbia, South Carolina, 1812.
Cooper, William, New York, 1828.
Cornay, J. C., Paris, 1861.
Corson, Dr. Jos. K., U. S. A., 1871.
Couch, D. N., U. S. A., 1853.
Coues, Elliott, M.D., U. S. Army, Washington, D. C., 1861
Couper, J. Hamilton, Darien, Georgia, 1842.
Couthouy, Joseph P., Boston, 1837.
Coutinho, J. M. da Silva, Rio de Janeiro, 1877.
Cowan, Hon. Edgar, Pennsylvania, 1861.
Cowan, Frank, Washington City, 1866.
Cox, J. C., Sydney, New South Wales, 1867.
Craft, James S., Pittsburg, Pennsylvania, 1831.
Cramer, Charles, St. Petersburg, Russia, 1834.
Craven, J. J., M.D., U. S. A., 1863.
Credner, Herman, New York, 1866.
Croom, H. P., Tallahasse, Florida, 1835.
Crosse, H. M., Paris, 1867.
Curtis, John, London, 1836.
Curtis, F., M.D., U. S. A., 1869.
Cuvier, Baron George, Paris, 1818.

Dall, Wm. H., Washington, D. C., 1869.
Dalton, Henry G., M.D., Demarara, 1852.
Dalton, John C. W., M.D., New York, 1854.
Dana, James D., New Haven, Connecticut, 1836.
Dana, Samuel L., Cambridge, Massachusetts, 1815.
Daniel, Wm. F., M.D., London, 1852.
Darlington, William, M.D., West Chester, Pennsylvania, 1818.
Darwin, Chas., F.R.S., F.G.S., London, 1860.
Davis, Edwin Hamilton, M.D., Chilicothe, Ohio, 1847.
Davis, Hon. Henry Winter, Baltimore, 1863.
Davis, J. Bernard, England, 1856.
Davis, John, Boston, 1812.
Dawson, J. W., Pictou, Nova Scotia, 1846.
Deabbate, Gaspard, Turin, 1823.
Dean, John, M.D., Boston, 1862.
Dearing, W. E., M.D., Augusta, Georgia, 1854.
Decaisne, Prof. Jos., Paris, 1862.

Desnoyes, G. F., Paris, 1852.
Desmarest, Anselme Gaetan, Paris, 1817.
Desmoulins, Chas., Bordeaux, 1859.
Desor, Prof. Edward, Neuchatel, 1877.
Dewey, Rev. Chester, Rochester, N. Y., 1832.
Dewey, Henry B., Para, Brazil, 1850.
Diesing, C. M., M.D., Vienna, Austria, 1851.
Dietz, Andrew R., St. Thomas, West Indies, 1839.
Dillwyn, Lewis W., Pennllergare, Wales, 1815.
Doane, George W., D.D., New Jersey, 1848.
Do Castello de Paiva, Baron, Lisbon, 1867.
Doddridge, C., M.D., Brook C. H., Virginia, 1812.
Doebereiner, Professor Johannes W., Jena, Austria, 1830.
D'Oleveira, D. Baptista, Rio de Janerio, 1855.
D'Orbigny, M. Alcide, Paris, 1834.
Doremus, R. Ogden, M.D., New York, 1855.
Dowler, Bennet, M.D., New Orleans, 1848.
Drake, Daniel, M.D., Cincinnati, Ohio, 1812.
Draper, John W., M.D., New York, 1836.
Drapier, A., Brussels, 1824.
Dresser, H. E., London, 1867.
Drouet, Henri, Troyes, 1867.
Du Bois, Prof. Alfred, Laurette, Park Co., Colorado, 1866.
Ducatel, Julius F., M.D., Baltimore, Maryland, 1812.
Duclos, M., Paris, 1833.
Duméril, Constant, Paris, 1818.
Duncan, Thomas, Rappahannock, Virginia, 1816.
Dunker, Professor Wm., Marburg, Cassel, 1859.
Dupont, Alfred, Wilmington, Delaware, 1821.
Durham, Geo. J., Austin, Texas, 1867.
Durieu de Maisonneuve, Prof.. Bordeaux. 1865.

Ehrenberg, Christian G., M.D., Berlin, 1848.
Eights, James, M.D., Albany, New York, 1837.
Elliott, Andrew, Pennsylvania, 1812.
Elliott, Stephen, Charleston, S. C., 1815.
Elliott, Rev. Stephen, Savannah, Georgia, 1856.
Ellis, W. Cox, Muncy, Pennsylvania, 1828.
Emerson, George B., Boston, 1840.
Emmons, Ebenezer, M.D., Albany, New York, 1840.
Enderlin, Charles, M.D., New York, 1854.
Engelmann, George, M.D., St. Louis, Missouri, 1840.
Escher, Henri, Switzerland, 1813.
Eschricht, Professor Daniel F., M.D., Copenhagen, 1848.
Esenbeck, Professor C. G. Nees von, Bonn, 1836.
Ettingshausen, Constantine von, 1859.
Evans, John, M.D., New Harmony, Indiana, 1850.
Eyton, Thomas C., Shropshire, England, 1846.

Falconer, Hugh, M.D., London, 1836.
Faraday, Prof. Michael, London, 1847.
Fancker, Sylvanus, Connecticut, 1815.
Favre, Prof. Alphonse, Geneva, 1877.
Fayrer, J., M.D., Calcutta, 1874.
Featherstonhaugh, G. W., Havre, 1830.
Fendler, Augustus, Allentown, Maryland, 1868.
Ferris, Z., Wilmington, Delaware, 1815.
Férussac, Baron d'Audebard de, Paris, 1816.
Fischer, Paul, M.D., Paris, 1867.
Fitton, William Henry, M.D., London, 1837.
Fitzinger, Professor Leopold, Vienna, 1832.
Flint, Austin, M.D., New York, 1876.
Flourens, P., Paris, 1859.
Flower, Prof. Wm. Henry, F.R.S., London, 1875.
Foote, John P., Cincinnati, Ohio, 1824.
Ford, Henry A., Glasstown, Gaboon River, Liberia, 1852.
Forster, Thomas, M.D., London, 1816.
Foster, J. W., Lake Superior, 1852.
Fowler, Samuel, M.D., Franklin, New Jersey, 1823.
Fox, Rev. Charles, Michigan, 1853.
Francis, John W., New York, 1816.
Frauenfeld, Geo. Ritter von, Vienna, 1859.
Frazer, Dr. Thos. R., Edinburg, 1873.
Frémont, John Charles, 1848.
French, Wm. H., White Haven, Luzerne Co., Pa., 1866.
Frick, Henry, Northumberland, Pennsylvania, 1831.
Fussel, Edwin, M.D., Indianapolis, Indiana, 1840.

Gadolin, Gen. A., St. Petersburg, 1877.
Galbraith, John, Venango, Pennsylvania, 1831.

Gay, Jacques, Paris, 1862.
Geddings, E., M.D.. Charleston, South Carolina, 1832.
Germar, Professor Ernst Friedrich, Halle, Saxony, 1828.
Gerolt, Baron von, Washington, 1846.
Gesner, Abraham, M.D., St. Johns, New Brunswick, 1840.
Gibbes, Lewis R., M.D., Charleston, South Carolina, 1844.
Gibbes, Robert W., M.D., Columbia, South Carolina, 1845.
Gibbs, George, New York, 1815.
Gill, Prof. Theodore, Washington, D. C., 1860.
Gilliss, J. M., U. S. N., Washington City, 1848.
Gilmer, Francis W., Albemarle County, Virginia, 1815.
Gilmore, Robert, Baltimore, Maryland, 1819.
Girard, Charles, M.D., Paris, 1851.
Giraud, Jacob P., Jr., New York, 1842.
Gliddon, George R., 1841.
Goheen, S. M. E , M.D., Columbia, Pennsylvania, 1840.
Goldfuss, Professor August, M.D., Bonn, Germany, 1832.
Goodsir, John D., Edinburgh, 1849.
Gorham, John, M.D., Harvard University, 1816.
Gould, Augustus A., M.D., Boston, 1840.
Gould, John, London, 1843.
Gourlie, William, Jr., Glasgow, 1846.
Graham, Colonel J. D., U. S. Topog. Eng., 1841.
Grant, Jas. A., M.D., Canada, 1863.
Grateloup, M., M.D., Bordeaux, 1836.
Gray, Asa, M.D., Cambridge, Massachusetts, 1836.
Gray, C. C., M.D., U. S. A., 1866.
Gray, George Robert, London, 1846.
Gray, John Edward, LL.D., London, 1823.
Gray, Robert, Glasgow, Scotland, 1866.
Green, Benjamin D., M.D., Boston, 1831.

Guérin-Méneville, F. E., Paris, 1861.
Guillemard, John, London, 1817.
Gummere, John, Burlington, New Jersey, 1816.
Gundlach, J., M.D., Havana, 1867.
Gurney, John Henry, Norfolk, England, 1867.
Guyot, Professor Arnold, Princeton, N. J., 1858.

Hadley, James, M.D., Fairfield, New York, 1828.
Haidinger, W. C., Vienna, 1851.
Haight, Richard K., New York, 1844.
Haines, John S., Northumberland, Pennsylvania, 1814.
Hall, James, Albany, New York, 1843.
Hamilton, W. J., London, 1859.
Hamlin, Dr. A. C., Bangor, Me., 1864.
Hammond, Ogden, Charleston, South Carolina, 1847.
Hammond, W. A., M.D., New York, 1853
Hancock, Albany, New Castle-upon-Tyne, England, 1869.
Hanley, Sylvanus, London, 1867.
Harden, John M. B., M.D., Liberty County, Georgia, 1846.
Harney, Wm. S., U. S. A., 1857.
Harris, Thaddeus W., M.D., Milton, Massachusetts, 1826.
Hartlaub, G., M.D., Bremen, 1852.
Hartman, W. D., M.D., West Chester, Pennsylvania, 1853.
Hassenfratz, J. H., Paris, 1819.
Hauer, Baron von, Vienna, 1851.
Haughton, Rev. Samuel, Dublin, Ireland, 1868.
Hauxwell, John, Pebas, Equador, 1871.
Hauy, L'Abbé, Paris, 1812.
Hayden, Horace H., Baltimore, Maryland, 1815.
Hayes, John Lord, Portsmouth, New Hampshire, 1814.
Hazlewood, George, London, 1821.
Hector, Dr. James, New Zealand, 1876.
Heer, Prof. Oswald, Zurich, 1859.
Henderson, Joseph, M.D., Mifflin County, Pennsylvania, 1838.
Henle, Dr. J., Göttingen, 1873.
Henry, Joseph, LL.D., Washington City, 1843.
Henry, T. Charlton, M.D., U. S. A., 1850.
Herbert, Rev. William, LL.D., Manchester, England, 1843.
Herrick, Edward C., New Haven, 1836.
Herschel, Sir J. F. W., Bart., London, 1847.
Hidalgo, J. Gonzales, Madrid, 1867.
Hildreth, Samuel P., M.D., Marietta, Ohio, 1832.
Hitchcock, Edward, LL.D., Amherst, Massachusetts, 1832.
Hochstetter, Ferdinand von, Vienna, 1877.
Hodgkin, Thomas, M.D., London, 1837.
Hodgson, W. B., Savanah, Georgia, 1843.
Hogg, Jabez, F.L.S., 1873.

Holbrook, John Edwards, M.D., Charleston, South Carolina, 1832.
Hollenbush, H. W., Reading, Penna., 1874.
Holmes, Ezekiel, M.D., Waterville College, Maine, 1826.
Holmes, Francis S., Charleston, South Carolina, 1848.
Holmes, Prof. Oliver Wendell, Boston, 1868.
Holmes, W. H., U. S. Geo. Surv., 1876.
Hooker, Dr. J. Dalton, Kew, England, 1873.
Hooker, Sir William Jackson, London, 1821.
Hooper, Robert, M.D., London, 1834.
Hornes, Moriz, M.D., Vienna, 1859.
Horsefield, S. C. C., India, 1830.
Horsfield, Thomas, M.D., London, 1826.
Hosack, David, M.D., New York, 1815.
Hough, Franklin B., M.D., Sommerville, New York, 1851.
Houghton, Douglass, M.D., Detroit, 1840.
Hoy, Philo R., M.D., Racine, Wisconsin, 1853.
Hubbard, Oliver P., M.D., Dartmouth College, New Hampshire, 1841.
Humboldt, Baron Alexander von, Berlin, 1843.
Hunt, David, M.D., Northampton, Massachusetts, 1815.
Hurry, William Cobb, Calcutta, 1832.
Huxley, Prof. T. H., F.R.S., London, 1859.
Hyatt, Alpheus, Salem, Mass., 1867.
Hyrtl, Professor Joseph, Vienna, 1851.

Ives, Ansel W., M.D., New York, 1817.

Jackson, Charles T., M.D., Boston, Massachusetts, 1833.
Jackson, J. B. S., M.D., Boston, Massachusetts, 1846.
Jackson, Robert M. S., M.D., Indiana County, Pennsylvania, 1848.
Jackson, William, Chester County, Pennsylvania, 1814.
Jäger, Prof. Geo. F., Stuttgart, 1859.
James, Edwin, M.D., U. S. A., 1823.
James, William, Halifax, Virginia, 1816.
Jameson, Robert, Edinburgh, 1822.
Jameson, William, M.D., Quito, Ecuador, 1836.
Jansen, Joseph, London, 1816.
Jardien, Ambrose, Paris, 1851.
Jarvis, Rev. T. Farmer, D.D., Middletown, Connecticut, 1837.
Jay, John C., M.D., Mamaroneck, West Chester Co., N. Y., 1835.
Jefferson, Thomas, LL.D., Virginia, 1818.
Jeffreys, J. Gwynn, London, 1867.
Jenkins, John Carmichael, M.D., Mississippi, 1836.
Jerdon, T. C., M.D., Madras, India, 1867.
Joaquin, Don José Arriago, Mexico, 1874.
Johnson, Wesley, M.D., Liberia, Africa, 1841.
Johnston, George, M.D., Berwick-on-Tweed, 1841.
Johnston, James F. W., Durham, England, 1838.

Johnston, John, Middletown, Connecticut, 1843.
Jolis, Auguste le, Cherbourg, France, 1858.
Jones, John Coffin, California, 1838.
Jones, Jos., M.D., Nashville, Tenn., 1858.
Jones, Thos. Rupert, 1864.
Jones, Thos. Rymer, F.R.S., London, 1859.
Jones, William, Calcutta, 1817.
Jones, Dr. William H., U. S. N., 1873.
Jones, William L., M.D., Riceboro, Georgia, 1848.
Jussieu, Antoine Laurent de, Paris, 1818.

Kaup, Professor Jean J., Darmstadt, 1848.
Keech, Alexander, A.F.C., Rappahannock, Virginia, 1816.
Kennedy, H. W., M.D., Buenos Ayres, 1852.
Kerr, Prof. W. C., Raleigh, North Carolina, 1871.
Kesteloot, Professor, Ghent, 1843.
King, Alfred T., M.D., Greensburg, Pennsylvania, 1844.
King, Henry, M.D., St. Louis, Missouri, 1840.
Kingsborough, Right Hon. Lord, London, 1837.
Kippist, Richard, London, 1846.
Kirkwood, Daniel, Bloomington, Ind., 1854.
Kirtland, J. P., M.D., Cleveland, Ohio, 1848.
Kite, Thos., Cincinnati, Ohio, 1865.
Knieskern, P. D., M.D., N. Jersey, 1865.
Kölliker, A., Wurzburg, 1869.
Kokscharow, Nikolai V., St. Petersburg, 1877.
Koninck, L. de, Brussels, 1877.
Korthals, P. W., M.D., Leyden, 1847.
Kotschubey, P. A. von, St. Petersburgh, 1877.
Krauss, Prof. F., Stuttgard, 1859.
Kuster, H. C., Cassel, 1867.

Lachmann, Johannes, Geneva, 1862.
Lacordaire, Th., Liege, 1848.
Lagos, Manuel Fereira, Rio Janerio, 1849.
Lakanal, Count, Paris, 1815.
Lamarck, Chev. de, Paris, 1818.
Laporte, Count de Castlenau, Paris, 1837.
Laporte, J. L., Bordeaux, 1832.
Latimer, Dr. L. E., New York, 1868.
Latreille, Pierre Andre, Paris, 1817.
Laugier, M., Paris, 1818.
Lawrence, George N., New York, 1847.
Lawrence, William, M.D., London, 1821.
Leach, W. Elford, M.D., London, 1818.
Le Beau, Justus, M.D., New Orleans, 1833.
Leconte, John, M.D., San Francisco, Cal., 1853.

Le Conte, Louis, 1815.
Lee, Henry, Westmoreland, Virginia, 1816.
Lefroy, M., Paris, 1817.
Leighton, James, M.D., Pittsburg, 1821.
Leman, M., Paris, 1817.
Leonhard, Karl Cæsar von, Heidelberg, 1824.
Lepsius, Professor Karl Richard, LL.D., Berlin, 1843.
Lesquereux, Leo, Columbus, Ohio, 1865.
Lesson, R. P., Paris, 1832.
Lettsom, William G., London, 1843.
Lewis, James, M.D., Mohawk, N. Y., 1861.
L'Herminier, Louis, M.D., Guadaloupe, 1817.
Liebig, Justus, M.D., Giessen, Germany, 1840.
Lincecum, Gideon, M.D., Long Point, Texas, 1867.
Lindley, John, Ph.D., London, 1841.
Linn, Dr. S. H., St. Petersburg, 1876.
Lobe, M. Guillaume, Havana, Cuba, 1836.
Locke, John, M.D., Cincinnati, Ohio, 1841.
Logan, Algernon Sidney, Germantown, Pennsylvania, 1815.
Logan, Sir William E., Montreal, Canada, 1846.
Long, Stephen H., U. S. A., 1817.
Longchamps, Ed. de Selys, Liege, 1842.
Lonsdale, William, London, 1847.
Loriol, Perceval de, Geneva, 1877.
Lovell, Joseph, M.D., U. S. A., Washington, 1823.
Lucas, J. A. H. (fils), Paris, 1817.
Ludlow, W. L., Col. Engineers U. S. Army, 1876.
Lund, P. W., Denmark, 1849.
Lyell, Sir Charles, London, 1832.
Lynch, William F., U. S. N., 1852.
Lyon, Sidney S., Indiana, 1863.

Mabille, Jules, Dinon, France, 1867.
Macartney, John P., E.D., City of Mexico, 1838.
Macauley, Patrick, M.D., Baltimore, 1816.
McCartee, D. B., M.D., China, 1861.
M'Clellan, Gen. George B., 1855.
MacCulloch, James, M.D., London, 1829.
M'Dowell, Ephraim, M.D., Danville, Kentucky, 1813.
Macfadyn, James, M.D., Kingston, Jamaica, 1835.
McFarland, Rev. James, 1838.
Macgillivray, William, Edinburgh, 1831.
Macknevin, William J., M.D., New York, 1814.
MacLeay, William Sharp, London, 1836.
MacOwan, Peter, Somerset, South Africa, 1874.
Magnanos, Julian, M.D., Norfolk, Virginia, 1812.
Malheiro, Prof. Laurenço, Lisbon, Portugal, 1876.

Malherbe, Alfred, Metz, France, 1850.
Mangouri, M., Paris, 1812.
Manigault, G. E., Charleston, S. C., 1866.
Mantell, Gideon A., LL.D., London, 1831.
Mantovani, Prof., Paolo, Rome, 1875.
Marcou, Prof. Jules, Zurich, 1860.
Marin, Col. Juan J., Madrid, 1876.
Markoe, Francis, Washington City, 1841.
Marsh, Dexter, Greenfield, Massachusetts, 1852.
Marsh, Geo. P., Florence, Italy, 1867.
Marsh, O. C., New Haven, Conn., 1867.
Martins, Charles, M.D., Paris, 1833.
Martius, Professor K. F. P. von, Munich, Austria, 1832.
Maskelyne, N. S., F.R.S., London, 1875.
Mason, Owen, Providence, Rhode Island, 1841.
Mather, William W., Ohio, 1838.
Maury, M. F., U.S.N., 1852.
Maximilian, Prince of Wied, 1864.
Meek, F. B., Washington, D. C., 1856.
Melsheimer, F. E., M.D., York County, Pennsylvania, 1843.
Melsheimer, Rev. Frederick Valentine, Hanover, Pennsylvania.
Menke, Charles Theodore, M.D., Pyrmont, Germany, 1837.
Mercier, M., Paris, 1812.
Meyer, Professor Hermann von, Frankford, Germany, 1832.
Michaux, F. A., Paris, 1818.
Michel, Myddleton, M.D., South Carolina, 1849.
Michener, Ezra, M.D., New Garden, Pennsylvania, 1840.
Miyhels, J. W., Portland, Maine, 1843.
Milbert, F., New York, 1821.
Miles, Professor Manly, Lansing, Mich., 1864.
Mintzer, Wm. A., Engineer Corps U. S. Navy, 1877.
Miot, A. F., Comte de Milito, Paris, 1825.
Mitchell, Elisha, Chapel Hill, North Carolina, 1832.
Mitchell, Prof. O. M., Cincinnati, Ohio, 1858.
Mitchell, Samuel L., LL.D., New York, 1812.
Mivart, Prof. St. George, F.R.S., London, 1875.
Moeller, Prof. Valerien de, St. Petersburg, 1877.
Mohrenstein, G. S. Von, Vienna, 1867.
Moleon, S. G. V. de, Paris, 1833.
Monger, Johannes, Leipsic, 1822.
Montgomery, Alexander, M.D., U. S. N., 1814.
Montgomey, Thomas W., M.D., New York, 1814.
Montral, Champvert, Guadaloupe, 1812.
Montrouzier, R. P., New Caledonia, 1867.
Mörch, Prof. O. A. L., Copenhagen, 1867.
Morelet, Arthur, Dijon, France, 1867.
Morgan, Lewis H., Rochester, N. Y., 1865.

Morinier, Noel de la, Paris, 1819.
Morphett, John, Adelaide, South Australia, 1845.
Morris, Rev. John G., D.D., Baltimore, 1844.
Morse, Edw. S., Portland, Maine, 1859.
Mortimer, Capt. J. H., December, 1874.
Motschulsky, Col. Victor de, St. Petersburg, 1854.
Mott, Valentine, M.D., New York, 1814.
Mousson, Albert, Zurich, 1839.
Mueller, Baron Ferdinand von, Melbourne, Australia, 1876.
Müller, Professor John, M.D., Berlin, 1845.
Müller (von), Baron Joh. Wm., 1856.
Muhlenberg, Rev. Henry, Lancaster, Pennsylvania, 1812.
Murchison, Sir Roderick Impey, London, 1832.
Murry, James W., Seville, Spain, 1814.
Mylius, C., Kronstadt, 1822.

Nevill, George, Calcutta, East Indies, 1868.
Nevill, Hon. H., Galle, Ceylon, 1871.
Newberry, J. S., M.D., New York, 1853.
Newcomb, Wesley, M.D., Oakland, Calif., 1867.
Newmann, Johann G., Gorlitz, 1859.
Newton, Alfred, London, 1861.
Nicholsky, Prof. L., St. Petersburg, 1877.
Nicholson, Charles, M.D., Sidney, New South Wales, 1846.
Nicollet, J. N., Washington, D. C., 1842.
Nilsson, Professor Sv., Lund, Sweden, 1847.
Nordmann, Alexander von, St. Petersburg, 1854.
Norman, Benjamin M., New Orleans, 1843.
Norwood, J. G., M.D., Madison, Indiana, 1842.
Nott, Josiah C., M.D., Mobile, Alabama, 1845.
Nuttall, Thomas Sutton, Lancashire, England, 1817.

Oakes, William, Ipswich, Massachusetts, 1830.
Oemler, Augustus J., Savannah, Georgia, 1812.
O'Kelly, Michael J., Dublin, Ireland, 1816.
Oken, Lorenz, Basle, Switzerland, 1837.
Olmsted, Denison, New Haven, 1828.
Ombrosi, James, Florence, Italy, 1843.
Orton, Prof. James, Rochester, N. Y., 1868.
Osten Sacken, Baron R. von, Russian Legation, New York, 1868.
Otis, Geo. A., M.D., U. S. A., Washington, D. C., 1866.
Owen, David Dale, M.D., New Harmony, Indiana, 1840.
Owen, Prof. Richard, London, 1834.

Packard, Dr. A. S., Salem, Mass., 1876.
Palmer, John, Calcutta, 1817.
Parent, M., Paris, 1820.

Parker, W. Kitchen, F.R.S., London, 1868.
Parkes, Samuel, London, 1821.
Parsons, Usher, M.D., Providence, Rhode Island, 1838.
Peirce, Prof. Benj., Cambridge, Mass., 1858.
Pentland, J. Barclay, London, 1821.
Percival, James G., M.D., New Haven, Connecticut, 1843.
Perkins, Jacob, Newburyport, Massachusetts, 1813.
Perley, M. H., St. Johns, New Brunswick, 1852.
Peter, Robert, M.D., Lexington, Kentucky, 1835.
Peters, Prof. Wilhelm C. H., Berlin, 1875.
Petit de la Saussaye, Paris, 1867.
Pfeiffer, Louis, M.D., Cassel, 1867.
Philippi, R. A., M.D., Santiago, Chili, 1867.
Phillips, John, York, England, 1843.
Pickering, Charles, M.D., Boston, 1826.
Piddington, Henry, Calcutta, 1836.
Pierpont, William, Barbadoes, 1812.
Pinart, M. Alphonse, Paris, 1876.
Pinel, M., M.D., Paris, 1815.
Pitcher, Zina, M.D., Detroit, 1830.
Planchon, Prof. J. E., Montpelier, France, 1873.
Playfair, Col. R. L., Algiers, 1870.
Pleasants, Henry, Pottsville, Penna., 1867.
Pleasonton, Alfred, U. S. A., 1857.
Poey, Prof. F., Havana, 1867.
Poinsett, Joel R., South Carolina, 1829.
Poli, Joseph Harrier, M.D., Naples, 1820.
Porcher, Francis P., M.D., Charleston, S. C., 1849.
Porta, Prof. Luigi Bombecci, Bologna, Italy, 1875.
Porter, Prof. T. C., Easton, Pennsylvania, 1853.
Porter, T. D., M.D., Columbia, South Carolina, 1822.
Postell, Jas., St. Simons Isle, Georgia, 1859.
Pouchet, Professor F. A., Rouen, France, 1842.
Poutrel, Alexander, Guadaloupe, West Indies, 1812.
Powell, J. W., Washington, D. C., 1872.
Pratten, Henry, New Harmony, Indiana, 1854.
Prévost, Constant, Paris, 1823.
Prichard, James Cowles, M.D., Bristol, England, 1838.
Prime, Temple, New York, 1862.
Prinsep, James, Calcutta, 1836.
Prout, Hiram A., M.D., St. Louis, 1854.
Putnam, F. W., Salem, Mass., 1867.

Quinby, J. B., 1836.

Raimondi, Antonio, M.D., Lima, Peru, 1867.
Rammelsberg, Prof. C. F., Berlin, 1859.
Randall, John, M.D., Boston, 1816.

Randall, John W., Boston, 1837.
Ranzani, Camillo, Bologna, 1827.
Rathvon, S. S., Lancaster, Pennsylvania, 1845.
Rauch, John H., Burlington, Iowa, 1856.
Ravenel, Edmund, M.D., Charleston, South Carolina, 1832.
Ravenel, Henry W., South Carolina, 1849.
Reclûz, M. C., Paris, 1867.
Redfield, William C., New York, 1841.
Reeve, Lovell, F.L.S., London, 1862.
Reichenbach, Professor H. G. L., Dresden, 1836.
Reinhardt, Prof. J., Copenhagen, 1867.
Reinhardt, J. C., M.D., Brazil, 1845.
Reinwardt, Prof. C. G. C., Leyden, 1821.
Rémond de Corbineau, Auguste, San Francisco, Cal., 1863.
Retzius, Professor, Andreas, Stockholm, 1846.
Reynolds, F. N., New York, 1837.
Reynolds, Henry S., M.D., U. S. N., 1835.
Reynolds, Wm. F., U. S. T. E., 1862.
Rhea, Matthew, Columbia, Tennessee, 1832.
Rich, William, Boston, Massachusetts, 1845.
Richardson, Sir John, M.D., London, 1832.
Richtofen, Baron Ferdinand Freihern von, Berlin, 1877.
Ricord, Alexander, Paris, 1823.
Ricord, Phillipe, Paris, 1823.
Riddell, John L., M.D., New Orleans, 1836.
Rijgersma, H. Evan, M.D., St. Martins, W. I., 1868.
Riley, Charles V., St. Louis, Mo., 1873.
Riley, William, M.D., Baltimore, 1833.
Rio, Prof. Andres del, Mexico, 1849.
Risso, J. A., Nice, France, 1818.
Riviere, E., Menton, France, 1872.
Robb, James, Frederickton, New Brunswick, 1846.
Römer, Prof. Edward von, Marburg, 1859.
Römer, Ferdinand, M.D., Bonn, 1859.
Roepper, Wm. Theo., Bethlehem, Penn., 1865.
Roesler, A. R., Washington, D. C., 1868.
Rogers, W. B., Boston, 1833.
Rolleston, Prof. George, F.R.S., Oxford, England, 1875.
Romanowsky, Lt.-Col. Hennadius, St. Petersburg, 1865.
Rose, Robert H., M.D., Silver Lake, Pennsylvania, 1833.
Ross, Bernard R., Hudson's Bay Co.'s Service, 1861.
Roxburgh, William, M.D., Calcutta, 1812.
Rucco, Julius, M.D., Naples, 1820.
Rüppel, Edward, M.D., Frankfort, Germany, 1830.
Rutemeyer, Prof. Ludwig, Basle, 1877.
Rutherfurd, Lewis M., New York, 1859.

Sager, Abram, M.D., Detroit, 1839.
Sagra, Ramon de la, Madrid, 1829.
St. Fonds, M. Faujas de, Paris, 1812.
St. Hilaire, Geoffrey, Paris, 1818.
Saldanha da Gama, José de, Rio Janeiro, 1876.
Saldanha da Gama, Luiz de, Imperial Navy of Brazil, 1876.
Salvin, Osbert, London, 1867.
Sandberger, Fridolin, M.D., Wiesbaden, 1855.
Sandberger, Guido, M.D., Wiesbaden, 1855.
Santos, C. A., Rio de Janeiro, 1855.
Saussure, Henri de, Geneva, 1859.
Sauvalle, F. A., Cuba, 1855.
Savage, Rev. Thomas S., M.D., Natchez, 1846.
Savi, Professor Paolo, Pisa, 1827.
Saynisch, Lewis, M.D., Tioga, Pennsylvania, 1836.
Scammon, Capt. C. M., San Francisco, California, 1872.
Schaum, H., M.D., Berlin, 1852.
Schimper, Prof. W. P., Strasburg, 1859.
Schoolcraft, Henry R., Washington, 1820.
Schouw, Professor J. Frederick, Ph.D., Copenhagen, 1848.
Schreibers, Charles Von, Vienna, 1818.
Schwaegrichen, Professor Fredk., M.D., Leipsic, 1836.
Schweinitz, Rev. Lewis D. Von, Ph.D., Bethlehem, Pennsylvania, 1822.
Sclater, Philip Lutley, London, 1856.
Scoresby, Rev. William, Yorkshire, England, 1848.
Scott, Andrew, M.D., Newbern, North Carolina, 1815.
Scudder, Saml. H., M.D., Boston, Mass., 1867.
Sealey, James, Cork, Ireland, 1820.
Sedgwick, Rev. Adam, London, 1843.
Selby, John Prideaux, Northumberland, England, 1847.
Serres, Marcel de, Montpellier, France, 1832.
Sewer, A. P., Lyons, 1867.
Shannon, John, Bearer, Pennsylvania, 1831.
Sharpey, William S., London, 1849.
Sheldon, Prof. D. S., Davenport, Iowa, 1862.
Shepard, Charles U., New Haven, 1828.
Short, Charles W., M.D., Lexington, Kentucky, 1831.
Showalter, E. R., M.D., Uniontown, Ala., 1861.
Shumard, Benjamin F., M.D., St. Louis, 1848.
Siebold, Carl Theo. von, Munich, 1859.
Siler, A. L., Osmer, Utah, 1874.
Silliman, Benjamin, M.D., LL.D., New Haven, 1815.
Silliman, Benjamin, Jr., New Haven, 1841.
Sims, Howard, Baltimore, Maryland, 1817.
Sinclair, Wm., Glasgow, 1866.
Skinner, Ezekiel, M.D., Liberia, 1837.
Smallwood, Prof. Chas., M.D., Montreal, 1860.

Smith, Lt.-Col. Charles Hamilton, London, 1846.
Smith, J. Brown, California, 1852.
Smith, J. Lawrence, Louisville, Kentucky, 1846.
Smith, Robert, St. Thomas, West Indies, 1851.
Solar, Jose del, Lima, 1855.
Sorby, Henry Clifton, Sheffield, Eng., 1858.
Southern, William, M.D., Maryland, 1812.
Souverbie, M., Bordeaux, 1867.
Sowerby, George B., London, 1841.
Sowerby, G. B., F.L.S., London, 1865.
Spach, Prof. Edouard, Paris, 1862.
Sparrman, Andreas, Univ. Upsal, 1818.
Spillman, Wm., M.D., Columbus, Miss., 1857.
Spinner, Hon. F. E., Washington, 1863.
Squier, George E., New York, 1847.
Stabile, Abbe Joseph, Milan, 1867.
Stacey, Col. L. R., Calcutta, 1838.
Stauffer, Jacob, Lancaster, Penna., 1866.
Stearns, R. E. C., San Francisco, Cal., 1867.
Stein, Dr. Friedrich, Prague, 1862.
Steiner, Lewis H., M.D., Frederick, Md., 1855.
Steinhauer, Rev. Henry, Bethlehem, Pennsylvania.
Stemberg, Gaspard, Comte de, Bohemia, 1821.
Stephens, John L., New York, 1843.
Sternberg, George M., U. S. A., 1872.
Stevens, Alexander H., M.D., New York, 1819.
Stevens, Edward, T., Salisbury, England, 1876.
Stevenson, James, U. S. Geological Survey, 1874.
Stevenson, John Jas., Morgantown, West Virginia, 1870.
Stodder, Chas., Boston, 1865.
Stoliczka, Dr. Ferdinand, Calcutta, 1868.
Storer, D. Humphreys, M.D., Boston, 1839.
Strain, Lt. Isaac G., U.S.N., 1843.
Stretch, R. H., San Francisco, California, 1868.
Strickland, Hugh E., London, 1848.
Sturm, Jacob, M.D., Nuremberg, 1847.
Styles, John, M.D., New York, 1834.
Suckley, George, M.D., New York, 1855.
Suess, Prof. Edward, Vienna, 1859.
Sullivant, William S., Ohio, 1844.
Swainson, William, New Zealand, 1830.
Swallow, G. C., Colombia, Mo., 1859.

Tait, Charles, Claiborne, Alabama, 1832.
Tamnau, Professor Frederick, Berlin, 1839.
Tappan, Benjamin, Ohio, 1842.
Tate, Ralph, London, England, 1868.

Taylor, Julius S., M.D., Carrolton, Ohio, 1845.
Temminck, Conrad Jacob, Leyden, 1824.
Thackara, J. M. S., Punca, Peru, 1866.
Thomas E., Baltimore, 1816.
Thompson, Allan, M.D., Edinburgh, 1834.
Thompson, William, Belfast, Ireland, 1848.
Thompson, John H., New Bedford, Mass., 1862.
Thornton, William, M.D., Washington, 1812.
Thurber, Geo., New York, 1861.
Tiedmann, Professor F., M.D., Heidelberg, 1848.
Tilden, Joseph, Boston, Massachusetts, 1812.
Tittel, Prof. Karl A., Munich, 1875.
Tomes, John, F.R.S., London, 1868.
Torrey, John, M.D., New York, 1822.
Totten, Jos. G., U. S. A., 1830.
Traill, Thomas Stewart, M.D., Edinburgh, 1835.
Traue, Dr. Thos. K., Edinburgh, 1873.
Trautschold, H., Moscow, 1877.
Travers, John, Jr., Lisbon, 1814.
Tremper, Jacob C., Yates County, New York, 1845.
Trescott, John S., M.D., Charleston, South Carolina, 1818.
Trimble, James, M.D., Williamsburg, Pennsylvania, 1836.
Trinius, Professor, M.D., St. Petersburg, Russia, 1836.
Tröschel, Prof. F. H., Bonn, 1867.
Tuckerman, Edward, Cambridge, Massachusetts, 1848.
Tuomey, M., Tuscaloosa, Alabama, 1845.
Turner, John, Maryland, 1814.
Turner, Dr. Theophilus H., U. S. A., 1868.
Twigg, William A., New Harmony, Indiana, 1841.

Unanué, Hippolito, M.D., Lima, Peru, 1821.
Ure, Andrew, M.D., Glasgow, 1829.

Vaillant, Leon, M.D., Paris, 1867.
Van Beneden, P. J., Bruxelles, 1864.
Vancleve, John, Dayton, Ohio, 1843.
Van Hoorebeke, Charles Joseph, Ghent, 1821.
Van Rensselaer, Jeremiah, M.D., New York, 1829.
Van Rensselaer, Stephen, Albany, New York, 1835.
Vargas, Jose Maria, M.D., Caracas, Venezuela, 1835.
Vauquelin, M., Paris, 1818.
Verneuil, Edouard de, Paris, France, 1846.
Verreaux, Jules, Paris, 1848.
Vogdes, A. W., U. S. Army, 1877.
Voltz, Louis Phillippe, Strasburg, Germany, 1833.

Wagner, Professor A., Munich, 1852.
Wailes, B. L. C., Washington, Mississippi, 1854.
Waldheim, Fischer de, Moscow, 1848.
Wallich, Nathaniel, M.D., Calcutta, 1819.
Walsh, Benjamin D., Illinois, 1861.
Ward, Malthus A., M.D., Athens, Georgia, 1832.
Warder, John A., M.D., Cincinnati, Ohio, 1842.
Warren, John C., M.D., Boston, Massachusetts, 1842.
Webber, Samuel, M.D., New Hampshire, 1851.
Webster, John W., M.D., Cambridge, Massachusetts, 1814.
Wetherill, Samuel R., Burlington, New Jersey, 1814.
Wheelwright, Joseph, M.D., Kentucky, 1814.
Whitney, J. D., Boston, 1852.
Wiedeman, D. R. G., M.D., Kiel, Germany, 1823.
Wilder, Burt G., Ithaca, N. Y., 1873.
Willis, John R., Halifax, Nova Scotia, 1867.
Wilson, Edward, Pembrokeshire, Wales, 1846.
Wilson, Hon. J. S., Washington, D. C., 1868.
Winchell, Alexander H., Ann Arbor, Mich., 1867.
Winslow, R. K., Cleveland, Ohio, 1854.
Wisely, J. J., M.D., Sioux Falls, Dacota Territory, 1866.
Wister, Charles J., Germantown, Pennsylvania, 1814.
Wood, Alphonso, Brooklyn, N. Y., 1867.
Wood, W. Maxwell, M.D., U.S.N., 1847.
Woodworth, John M., Chicago, 1861.
Worth, James, Bucks County, Pennsylvania, 1823.
Wray, Thomas J., M.D., Augusta, Georgia, 1818.
Wright, W. W., York Springs, Pa., 1859.
Wyman, Jeffries, M.D., Boston, Massachusetts, 1844.
Wynne, James, M.D., New York, 1861.

Yarrell, William, London, 1829.
Yorke, Gen. L. E., Cincinnati, Ohio, 1871.

Zaremba, C. William, St. Joseph's, Mich., 1867.
Ziegler, Rev. Daniel, York, Pennsylvania, 1844.
Zimmerman, Chs., M.D., Columbia, South Carolina, 1836.
Zollickoffer, William, M.D., Middletown, Maryland, 1834.
Zuccarini, Professor Joseph G., Munich, Bavaria, 1846.

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William Maclure,	Dec. 31, 1817,	Mar. 23, 1840.*
William Hembel,	May 26, 1840,	Dec. 1849.
Samuel George Morton, M.D.,	Dec. 1849,	May 15, 1851.*
George Ord,	" 1851,	Dec. 1858.
Isaac Lea, LL.D.,	" 1858,	" 1863.
Thomas B. Wilson, M.D.,	" 1863,	June 28, 1864.
Robert Bridges, M.D.,	" 1864,	Dec. 1865.
Isaac Hays, M.D.,	" 1865,	" 1869.
W. S. W. Ruschenberger, M.D.,	" 1869.	

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Zaccheus Collins,	Dec. 26, 1815,	June 13, 1831.*
George Ord,	" 31, 1816,	Dec. 1834.
Wm. Hembel,	July 26, 1831,	May 28, 1840.
John Price Wetherill,	Dec. 1834,	July, 1853.*
Sam'l Geo. Morton, M.D.,	May 28, 1840,	Dec. 1849.
R. Eglesfield Griffith, M.D.,	Dec. 1849,	June 26, 1850.*
Robert Bridges, M.D.,	Sept. 24, 1850,	Dec. 1864.
Isaac Lea,	Dec. 1853,	" 1858

* Died.

	Elected	*Served until*
John Le Conte,	Dec. 1858,	Nov. 21, 1860.*
William S. Vaux,	" 1860,	Dec. 1874.
John Cassin,	" 1864,	Jan. 1869.*
W. S. W. Ruschenberger, M.D.,	Jan. 26, 1869,	Dec. 1869.
Joseph Carson, M.D.,	Dec. 1869.	" 1875.
John L. Le Conte, M.D.,	" 1874.	
William S. Vaux,	" 1875.	

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Robert Hare, M.D.,	Dec. 28, 1813,	Feb. 15, 1814.
Reuben Haines,	Feb. 15, 1814,	Dec. 1831.
Sam'l Geo. Morton, M.D.,	Dec. 1831,	May 28, 1840.
Robert Bridges, M.D.,	May 28, 1840,	Dec. 1841.
Walter R. Johnson,	Dec. 1841,	" 1848.
John Cassin,	" 1848,	" 1852.
John L. Le Conte, M.D.,	" 1852,	" 1859.
Thomas Stewardson, M.D.,	" 1859,	" 1866.
Joseph Jeanes,	" 1866,	Feb. 26, 1867.
Harrison Allen, M.D.,	Feb. 26, 1867,	Jan. 28, 1868.
Edward D. Cope,	Jan. 28, 1868.	Dec. 26, 1876.
Geo. H. Horn, M.D.,	Dec. 26, 1876.	

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Camillus Macmahon Mann, M.D.,	Jan. 25, 1812,	Dec. 1812.
John Barnes, M.D.,	Dec. 5, 1812,	Aug. 1813.
Benjamin Say,	Aug. 24, 1813,	Mar. 1, 1814.
John Barnes, M.D.,	Mar. 8, 1814,	Dec. 30, 1817.
Edward Barton, M.D.,	Dec. 30, 1817,	" 28, 1819.
Franklin Bache, M.D.,	" 29, 1819,	" 25, 1821.
Wm. H. Keating, M.D.,	" 25, 1821,	Dec. 1825.
S. G. Morton, M.D.,	Dec. 1825,	" 1829.
Thomas McEuen, M.D.,	" 1829,	" 1835.
Thomas D. Mutter, M.D.,	" 1835,	" 1836.
Joseph Carson, M.D.,	" 1836,	June 20, 1837.
Thomas Stewardson, M.D.,	June 1837,	Jan. 7, 1840.
A. D. Chaloner, M.D.,	Feb. 4, 1840,	Dec. 1841.

* Died.

	Elected	*Served until*
Wm. S. Zantzinger, M.D.,	Dec. 1841,	Dec. 1846.
Theodore F. Moss,	" 1846,	Sept. 28, 1847.
John Lambert,	Oct. 26, 1847,	Dec. 1848.
William Gambel, M.D.,	Dec. 1848,	" 1849.
Samuel Powel,	" 1849,	" 1851.
B. Howard Rand, M.D.,	" 1851,	Oct. 31, 1865.
H. C. Wood, Jr., M.D.,	Oct. 31, 1865,	Feb. 26, 1867.
Samuel B. Howell, M.D.,	Feb. 26, 1867,	Dec. 1874.
Edward J. Nolan, M.D.,	Dec. 1874.	

TREASURERS.

John Speakman,	Dec. 28, 1813,	April 26, 1814.
Wm. S. Warder,	Nov. 29, 1814,	Feb. 1815.
Richard Randolph,	Feb. 7, 1815,	Dec. 1815.
Benjamin Say,	Dec. 26, 1815,	July 30, 1816.
Jacob Gilliams,	July 30, 1816,	Dec. 1826.
George W. Carpenter,	Dec. 1826,	June 7, 1860.*
William C. Henszey,	June 26, 1860.	

LIBRARIANS.

John Speakman,	Nov. 29, 1814,	Dec. 26, 1815.
Caleb Richardson,	Dec. 26, 1815,	" 30, 1817.
Jacob Pierce,	" 30, 1817,	Dec. 1826.
S. W. Conrad,	Dec. 1826,	" 1829.
Charles Pickering, M.D.,	" 1829,	" 1833.
Paul Beck Goddard, M.D.,	" 1833,	" 1834.
Joseph Carson, M.D.,	" 1834,	" 1836.
Robert Bridges, M.D.,	" 1836,	May 1839.
Alfred Langdon Elwyn, M.D.,	May, 1839,	Dec. 1845.
Joseph Leidy, M.D.,	Dec. 1845,	" 1846.
Wm. S. Zantzinger, M.D.,	" 1846,	July 29, 1856.
J. Aitken Meigs, M.D.,	Aug. 1856,	May 31, 1859.
James C. Fisher, M.D.,	June 28, 1859,	Aug. 27, 1861.
R. E. Griffith, M.D.,	Dec. 1861,	Jan. 28, 1862.
J. D. Sergeant,	Jan. 28, 1862,	Dec. 1867.
Edward J. Nolan, M.D.,	Dec 1867.	

* Died.

CURATORS.

	Elected	*Served until*
Thomas Say,	Mar. 1812,	Dec. 1826.
Isaiah Lukens,	Dec. 28, 1813,	Dec. 26, 1815.
Jacob Gilliams,	" 26, 1815,	" 31, 1816.
George Ord,	" 26, 1815,	" 30, 1817.
Lardner Vanuxem,	" 31, 1816,	" 30, 1817.
Titian R. Peale,	" 30, 1817,	" 28, 1819.
C. A. Le Sueur,	" 30, 1817,	Dec. 1825.
J. Price Wetherill,	" 28, 1819,	" 1825.
Thomas McEuen, M.D.,	" 26, 1820,	" 1821.
Isaac Hays, M.D.,	" 25, 1821,	" 1831.
Richard Harlan, M.D.,	" 28, 1819,	Dec. 25, 1821.
T. R. Peale,	Dec. 1825,	Dec. 1831.
John Vaughan,	" 1825,	" 1827.
J. P. Wetherill,	" 1826,	" 1835.
Isaiah Lukens,	" 1827,	" 1829.
Thomas McEuen, M.D.,	" 1829,	" 1839.
Samu'l G. Morton, M.D.,	" 1831,	" 1832.
Chas. A. Poulson,	" 1831,	" 1834.
Chas. Pickering, M.D.,	" 1833,	" 1837.
Isaiah Lukens,	" 1834,	" 1835.
Paul Beck Goddard, M.D.,	" 1834,	" 1835.
Walter R. Johnson,	" 1835,	" 1837.
T. A. Conrad,	" 1835,	" 1836.
Edward Hallowell, M.D.,	" 1836,	" 1839.
William Blanding, M.D.,	" 1837,	" 1838.
Thomas Nuttall,	" 1837,	" 1838.
Wm. S. Vaux,	" 1838.	
Robert Pearsall,	" 1838,	Dec. 1842.
J. K. Townsend,	" 1839,	" 1840.
G. C. Leib,	" 1839,	" 1841.
John S. Phillips,	" 1840,	" 1843.
Samuel Ashmead,	" 1841,	" 1858.
John Cassin,	" 1842,	Jan. 1869.*
Gavin Watson, M.D.,	" 1843,	Dec. 1845.

* Died.

	Elected	*Served until*
John K. Townsend, M.D.,	Dec. 1845,	Dec. 1846.
Joseph Leidy, M.D.,	" 1846.	
J. D. Sergeant,	" 1858,	Dec. 1865.
E. D. Cope,	" 1865,	" 1873.
George W. Tyron, Jr.,	Jan. 26, 1869,	July 1876.
Charles F. Parker,	Dec. 1873.	
Henry C. Chapman, M.D.,	Aug. 8, 1876.	

AUDITORS.

John Speakman,	Sept. 6, 1814,	Dec. 31, 1816.
Benjamin Say,	" 6, 1814,	" 26, 1820.
Richard Randolph,	" 6, 1814,	" 26, 1820.
R. E. Griffith, M.D.,	Dec. 31, 1816,	" 26, 1820.
Joseph H. Dulles,	" 26, 1820,	Dec. 1823.
Isaac Lea,	" 26, 1820,	" 1823.
Caleb Carmalt,	" 26, 1820,	Dec. 25, 1821.
R. E. Griffith, M.D.,	" 25, 1821,	Dec. 1824.
W. S. Warder,	Dec. 1823,	" 1824.
J. M. Brewer,	" 1823,	" 1825.
S. G. Morton, M.D.,	" 1824,	" 1826.
J. Dobson,	" 1824,	" 1829.
Geo. W. Carpenter,	" 1825,	" 1826.
S. V. Merrick,	" 1826,	" 1829.
W. M. Walmsley,	" 1826,	" 1827.
C. W. Pennock, M.D.,	" 1827,	" 1829.
C. Hedelius,	" 1829,	" 1832.
Thomas McEuen, M.D.,	" 1829,	" 1831.
P. B. Goddard, M.D.,	" 1829,	" 1832.
William Norris, Jr.,	" 1831,	" 1832.
Walter R. Johnson,	" 1832,	" 1835.
Daniel Steinhauer,	" 1832,	" 1833.
Robert E. Peterson,	" 1832,	" 1835.
Thomas D. Mütter, M.D.,	" 1833,	" 1836.
Robert E. Peterson,	" 1836,	" 1839.
Algernon S. Roberts,	" 1836,	" 1837.
Wm. S. Vaux,	" 1836,	" 1852.
A. D. Chaloner, M.D.,	" 1837,	" 1838.
R. Pearsall,	" 1838,	" 1857.

	Elected	*Served until*
R. Peters,	Dec. 1839,	Dec. 1840.
A. D. Chaloner, M.D.,	" 1840,	" 1842.
W. S. Zantzinger, M.D.,	" 1842,	" 1843.
Robert Bridges, M.D.,	" 1843,	" 1849.
Samuel Ashmead,	" 1849,	" 1852.
A. L. Elwyn, M.D.,	" 1852,	" 1854.
James C. Fisher, M.D.,	" 1852,	" 1855.
Samuel Ashmead,	" 1854,	" 1858.
William S. Vaux,	" 1855,	" 1869.
Joseph Jeanes,	" 1857,	" 1869.
Aubrey H. Smith,	" 1858,	" 1869.

COMMITTEE ON FINANCE.

Robert Bridges, M.D.,	Dec. 1869.
Wm. S. Vaux,	" 1869.
Aubrey H. Smith,	" 1869.

PUBLICATION COMMITTEE.

March 25, 1817, a committee was appointed to devise a plan and make arrangements to publish a Journal. It consisted of Wm. Maclure, Thomas Cooper, M.D., Robt. M. Patterson, M.D., Thomas Say, Reuben Haines, George Ord, Thomas Nuttall, and Joseph H. Dulles. These eight gentlemen served until December 1818. Then a publication committee, which included three of them, was elected.

On the 20th of May, 1817, the first part of the Journal of the Academy of Natural Sciences of Philadelphia was reported ready to be distributed.

George Ord,	Dec. 1, 1818,	Jan. 30, 1821.
Thomas Say,	" 29, 1818,	Dec. 1825.
R. E. Griffith, M.D.,	" 29, 1818,	May 4, 1819.
Thomas Nuttall,	Jan. 30, 1821,	Dec. 1822.
Joseph H. Dulles,	Dec. 29, 1818,	" 1821.
Isaac Hays, M.D.,	Jan. 30, 1821,	" 1825.
Isaac Lea,	" 30, 1821,	" 1825.
R. E. Griffith, M.D.,	Dec. 25, 1821,	" 1825.
Zaccheus Collins,	Mar. 30, 1819,	Jan. 30, 1821.
W. H. Keating,	Dec. 1822,	Dec. 1825.
S. G. Morton, M.D.,	" 1825,	" 1829.
J. P. Wetherill,	" 1825,	" 1829.
William Wetherill, M.D.,	" 1825,	" 1829.

	Elected	*Served until*
J. P. Smith,	Dec. 1825,	Dec. 1829.
R. Harlan, M.D.,	" 1825,	" 1829.
Thos. McEuen, M.D.,	" 1829,	" 1832.
S. W. Conrad,	" 1829,	" 1831.
C. Pickering, M.D.,	" 1829,	" 1833.
I. Lukens,	" 1829,	" 1831.
Charles A. Poulson,	" 1831,	" 1835.
George Ord,	" 1832,	" 1833.
Alfred Langdon Elwyn, M.D.,	" 1833,	" 1845.
Thomas F. Betton, M.D.,	" 1833,	" 1835.
Wm. P. Gibbons, M.D.,	" 1833,	" 1836.
Thos. McEuen, M.D.,	" 1835,	" 1839.
H. D. Rogers,	" 1835,	" 1836.
Walter R. Johnson,	" 1836,	" 1837.
Joseph Carson, M.D.,	" 1836,	" 1841.
Edward Hallowell, M.D.,	" 1836,	" 1837.
Lewis C. Gunn,	" 1837,	" 1839.
Robert Bridges, M.D.,	" 1837,	" 1838.
T. A. Conrad,	" 1838,	" 1840.
G. C. Leib,	" 1839,	" 1840.
Ed. Hallowell, M.D.,	" 1839,	" 1843.
Wm. S. Vaux,	" 1840,	
John Simmons,	" 1840,	" 1841.
John S. Phillips,	" 1841,	" 1844.
W. S. Zantzinger, M.D.,	" 1841,	" 1843.
T. A. Conrad,	" 1843,	" 1845.
E. Draper,	" 1843,	" 1844.
A. E. Jessup,	" 1844,	" 1846.
John Simmons,	" 1843,	" 1845.
Walter R. Johnson,	" 1845,	" 1848.
Samuel Ashmead,	" 1845,	" 1849.
William Gaubel, M.D.,	" 1845,	" 1849.
Thos. B. Wilson, M.D.,	" 1846,	" 1847.
Robt. E. Griffith, M.D.,	" 1847,	June 26, 1850.*
Sam'l Geo. [redacted]	" 1848,	May 15, 1851.*

* Died.

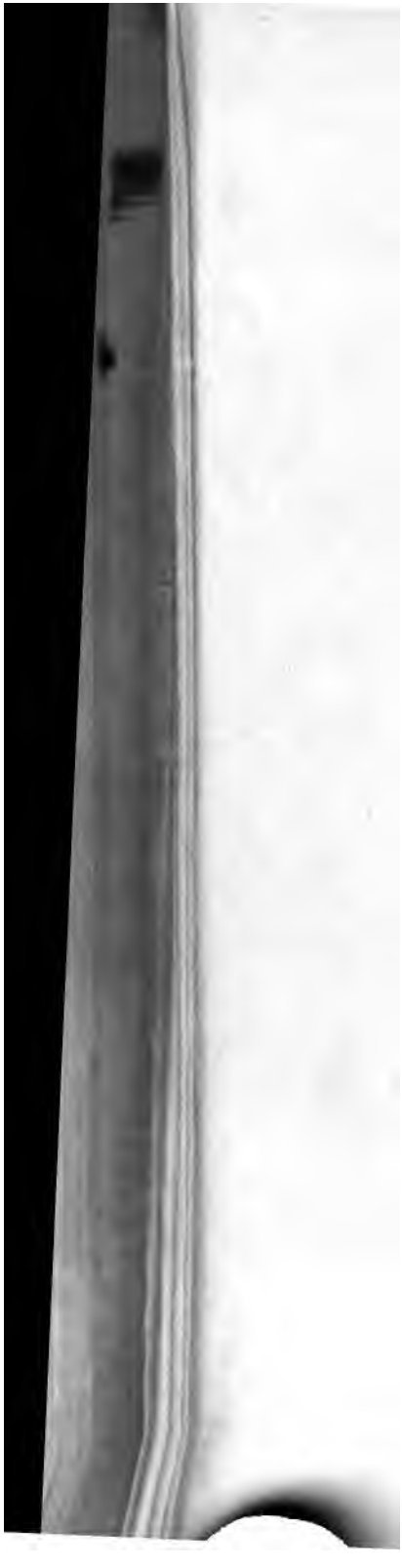
	Elected	*Served until*
Thomas B. Wilson, M.D.,	Dec. 1849,	Dec. 1853.
Robert Bridges, M.D.,	" 1849,	" 1872.
Samuel Powel,	" 1850,	" 1851.
Isaac Lea, LL.D.,	" 1851,	" 1865.
W. S. W. Ruschenberger, M.D.,	" 1851,	Sept. 1854.
H. C. Hanson,	" 1853,	Dec. 1857.
Joseph Leidy, M.D.,	" 1854.	
W. S. W. Ruschenberger, M.D.,	" 1857,	July 26, 1860.
Thomas Stewardson, M.D.	" 1860,	Dec 1865.
George W. Tryon, Jr.,	" 1865,	" 1868.
John Cassin,	" 1865,	Jan. 1869.*
Edward J. Nolan, M.D.,	" 1868,	Dec. 1875.
James Tyson, M.D.,	1869,	" 1870.
George W. Tryon, Jr.,	Dec. 1870.	
W. S. W. Ruschenberger, M.D	" 1872.	
George H. Horn, M.D.,	" 1875.	

COUNCILORS †

Isaac Lea, LL.D.,	Dec. 1869,	Dec. 1874.
Isaac Hays, M.D.,	" 1869,	" 1874.
Robert Bridges, M.D.,	" 1869,	May 16, 1876.
Edward S. Whelen,	" 1869,	
John L. Le Conte, M.D.,	" 1874,	Feb. 23, 1875.
R. S. Kenderdine, M.D.,	" 1874.	
George H. Horn, M.D.,	Feb. 23, 1875.	
J. H. Redfield,	May 16, 1876.	
J. G. Hunt, M.D.,	" "	
Joseph Wharton,	" "	
Joseph Jeanes,	" "	
George A. Köenig, Ph.D.,	" "	
George Vaux,	" "	
J. S. Haines,	" "	
W. H. Dougherty,	" "	
Harrison Allen, M.D.,	" "	

* Died.

† From 1869 until May, 1876, the council consisted of the officers of the Academy and four councilors, elected annually for one year. Now there are twelve councilors: four to be elected annually for three years.



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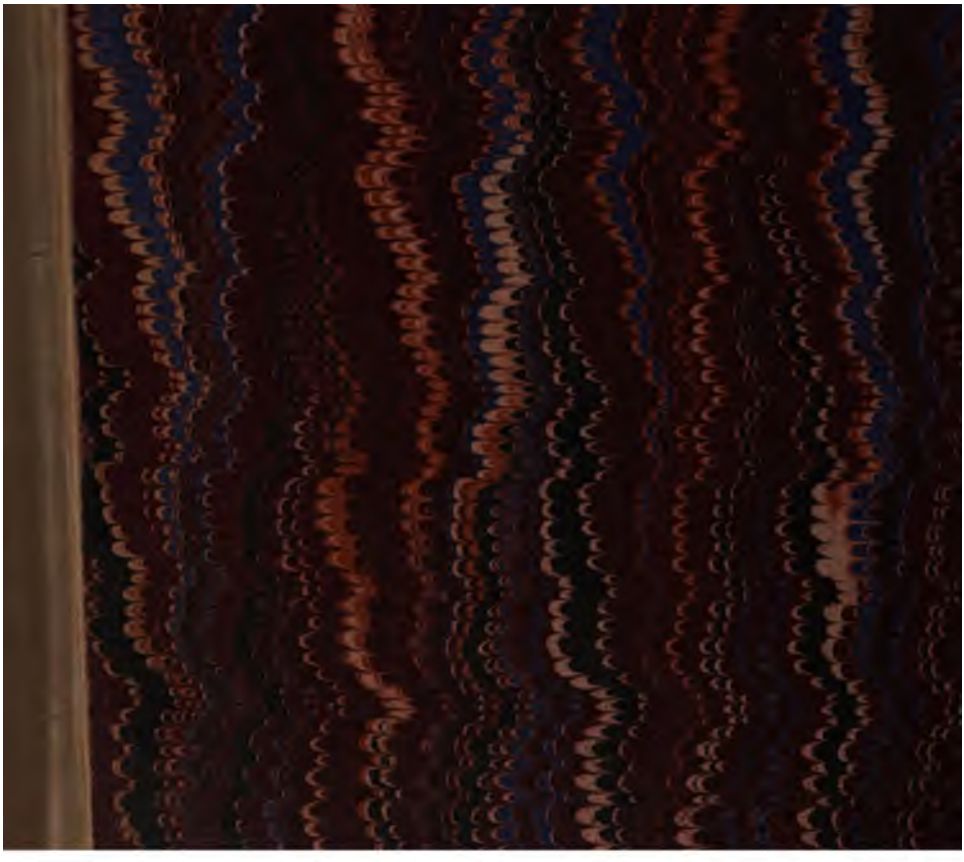

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